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MUNICIPAL ENGINEERING

VOLUME XXVI MARCH, NINETEEN HUNDRED FOUR NUNBER THREE

THE CEMENT SITUATION.

The data gathered for the third edition of the "Directory of American Cement Industries" now in press and to be issued shortly, show conclusively the healthy condition of the cement trade and the good prospects for further rapid development, provided financial and labor troubles do not delay investment in construction of the many public and private works which are now necessary or will be in the near future.

The invasion of new fields of construction and the more thorough covering of the old ones by cement promise some years of increase in the demand which will tax the facilities of the existing companies and encourage the formation of new ones. The following tables will give a birdseye view of the past and a basis for some idea of what the immediate future will be.

The first table gives the number of works, the product in barrels and the value of the cement in bulk for each year since 1895. The figures for 1903 are estimates. The 63 in the column of "No. of Works" is the number of the companies manufacturing cement, and to be on the same basis as the other figures in the column should be increased by the number of plants operated by companies in addition to their original plans. This does not affect the total production, but explains the discrepancy in number of plants. The product for 1903 is estimated at 1,000,000 barrels higher than the estimate made in February, 1903, and is probably as conservative as the estimates made in the article on page 83 of Municipal Engineering of that date. The great fluctuation in prices in 1903 makes the assumption of an average price of bulk cement at the mill difficult. That assumed, $1.10 a barrel, may differ from the official report, as that may be influenced by the date the reports are made.

PRODUCTION AND VALUE OF PORTLAND CEMENT IN THE UNITED STATES.

Year.	No. of Works.	Product. Barrels.	Value.
1895.....	22	990,324	$1,586,830
1896.....	26	1,543,023	2,424,012
1897.....	29	2,677,775	4,315,891
1898.....	31	3,692,284	5,970,773
1899.....	36	5,652,266	8,074,371
1900.....	50	8,482,020	9,280,525
1901.....	56	12,711,225	12,532,360
1902.....	68	17,230,644	20,684,078
1903.....	*63	!20,700,000	!22,770,000

*Number of manufacturing companies.
!Estimated.

At the close of 1903 there were 68 different companies manufacturing Portland cement in the United States, the number of works at different locations on the basis of the U. S. Geological Survey reports being larger by some 6 or 8. The maximum capacity of these companies, as taken from their reports to the Directory, assuming 300 days as the length of the operating year, was 40,000,000 barrels a year. The estimated production of these companies was almost exactly half this capacity. Comparison of reported figures for 1903 shows very nearly the same relation of capacity and actual production. There are several reasons for the difference. Few plants can operate all their machinery fully 300 days a year. Many sections of plants have recently been thrown out of use for considerable periods to make changes in machinery or its arrangement or for the purpose of enlargement. Some companies have been in financial difficulties from faults of management or otherwise. Some have had difficulty in disposing of their product on account of local overstocking of market, defective quality, etc. Some give the maximum capacity under forced speed which cannot be maintained continuously. The labor troubles, as last year, cause general overstocking. The

sum of these effects cuts down the total production to about half the capacity.

The reports indicate that there will be 8 or 10 new mills put in operation during 1904, which will increase the capacity some 10 or 12 per cent. The average capacity of the mills in operation is not quite 2,000 barrels a day. The average production, with figures for former years for comparison, is given in the following table:

AVERAGE PRODUCT PER MILL AND VALUE OF PORTLAND CEMENT.

Year.	Av. Product of Each Mill Brls. a Day.	Av. Value at Mill Per Brl.
1895	150	$1 60
1896	197	1 57
1897	308	1 61
1898	397	1 62
1899	523	1 43
1900	565	1 09
1901	757	0 99
1902	912	1 21
1903	*958	*1 10

*Estimated.

For 1903 the average product is per company; that per mill would probably be about 900 barrels. The limit of increase in production per mill seems to be very nearly reached. The average capacity of the mills likely to go into operation in 1904 is perhaps 100 barrels a day less than the average of those now in operation, and the average production per mill, unless there is a great demand for cement in 1904 to crowd the mills, will not be greater than in 1903.

There are very many companies listed in the Directory of American Cement Industries as projected, some being under construction. There are about thirty-five of these which state the proposed capacity of their mills, and, if constructed they would increase the total capacity of mills about 40 per cent. Very few, if any, of these will be completed in 1904 and but few more in 1905. Judging from the list of discontinued names of cement companies given in the directory, many of them will fall by the wayside. Some of the most promising projects have not yet been put into official form and therefore do not appear in the lists.

The following table gives the data regarding the actual consumption of cement in the United States. The figures for imported cement have been corrected for the years 1900 to 1902, deducting the amount of cement re-exported, and the figures for domestic Portland cement have been corrected for the same years by deducting the exportations, so that since 1900 the table shows the actual domestic consumption and not the production and importation. Assuming the consumption of domestic Portland cement to be 20,400,000 barrels in 1903, it will be seen that the increase in the use of domestic Portland cement has been very nearly 4,000,000 barrels each year since 1900. The increase in capacity by addition of new mills for 1904 is but little more than four million barrels and the actual production will be somewhat less. The new works will therefore scarcely be able to take care of the increase if it is equal in amount to that of the recent years.

TOTAL CONSUMPTION OF CEMENT IN THE UNITED STATES.

Year.	Natural.	Imported.	Domestic Portland.	Puzzolan.
To 1880	54,970,000	793,281	82,000	.....
1880	2,030,000	187,000	42,000	.....
1881	2,440,000	221,000	60,000	.....
1882	3,165,000	370,406	85,000	.....
1883	4,190,000	486,418	90,000	.....
1884	4,000,000	585,768	100,000	.....
1885	4,100,000	554,396	150,000	.....
1886	4,186,152	650,032	150,000	.....
1887	6,692,744	1,070,400	250,000	.....
1888	6,253,295	1,835,504	250,000	.....
1889	6,331,876	1,740,356	300,000	.....
1890	7,082,204	1,940,186	335,000	.....
1891	7,451,535	2,988,313	454,813	.....
1892	8,211,181	2,440,654	547,440	.....
1893	7,411,815	2,674,149	590,652	.....
1894	7,563,488	2,638,107	798,757	.....
1895	7,741,077	2,997,395	990,324	.....
1896	7,970,450	2,989,597	1,543,023	.....
1897	8,311,688	2,090,924	2,677,775	.....
1898	8,418,924	2,043,818	3,692,284	.....
1899	9,868,179	2,108,388	5,652,266	233,000
1900	8,383,519	2,386,683	8,482,020	365,611
1901	7,084,823	893,445	12,337,291	272,689
1902	8,044,305	1,926,704	16,889,823	478,555
1903	†7,000,000	2,017,303	†20,400,000	†600,000

†Estimated.

The increase in the amount of imported, natural and puzzolan cements from 1901 to 1902 is about 2,200,000 barrels, of which 1,000,000 barrels is in foreign cements. The increase in use of domestic Portland cements from 1901 to 1902 of 4,500,000 barrels, shows a total increase in cement consumption of 6,700,000 barrels and indicates the inability of the domestic plants to meet all the demands in 1902.

The estimated increase in domestic use of domestic Portland cement from 1902 to 1903 is a little less than 4,000,000 barrels. The actual domestic consumption of foreign cements was practically the same as in 1902. The figures for consumption of natural cement are not available, but expert estimates of one district indicate that the production for 1903 was fully 1,000,000 barrels less than in 1902, or was about the same as in 1901.

If the natural development of the cement trade is not interfered with by la-

I. BIG MUDDY CONCRETE BRIDGE, ILLINOIS CENTRAL RAILROAD,
Showing Main Arch Voussoirs and Part of Centering and Molds for Spandrel Arches.

bor and financial troubles on the one hand, or by concerted restriction in production on the other, it seems probable that the plants in operation in 1904 will be practically equal to the demands made upon them. An increase in demand beyond that estimated is probable under favorable conditions and must be met, if it occurs, by importation largely. A decrease in demand, on account of decrease in construction, must be met by a restriction of production. Although this is a presidential year the prospects for a good season in construction lines are excellent, and an increase in demand is more probable than a decrease.

The following table gives the increase in the consumption of cement per capita in the United States:

CONSUMPTION OF CEMENT IN UNITED STATES PER CAPITA OF POPULATION.

		Consumption, Pounds per Capita.	
Year.	Population.	Portland.	All Kinds.
1880	50,155,783	1.7	13.1
1890	62,622,250	13.8	45.5
1900	75,559,258	54.7	87.3
1902	78,611,628*	91.0	121.5

*Estimated.

There is still some room for displacement of natural cement by Portland cement, though it is probable that the present use of natural cement will not be very greatly diminished. The statement that Germany produced in 1900 135 barrels of Portland cement per capital indicates a chance for considerable expansion in its use in this country. Germany uses cement largely for many purposes for which this country as yet uses only small quantities. On the other hand, this country has extended some uses far beyond their application in other countries. It is probable, therefore, that the per capita consumption of cement in this country will ultimately exceed that in Germany. Our export trade is but just beginning and probably only requires cultivation to take a considerable percentage of our production. Until we can take care of the domestic demand it is not probable that much time and effort will be spent upon the foreign trade.

The growth in the manufacture of puzzolan cement is interesting. The capacity of the plants which will be in operation at some time during 1904 is fully 1,600,000 barrels a year and the actual production will probably be materially greater than that estimated for 1903.

The natural hydraulic cement mills have an actual capacity of approximately 25,000,000 barrels a year. Their annual production is about 30 per cent. of their capacity, as compared with 50 per cent. for Portland cement plants.

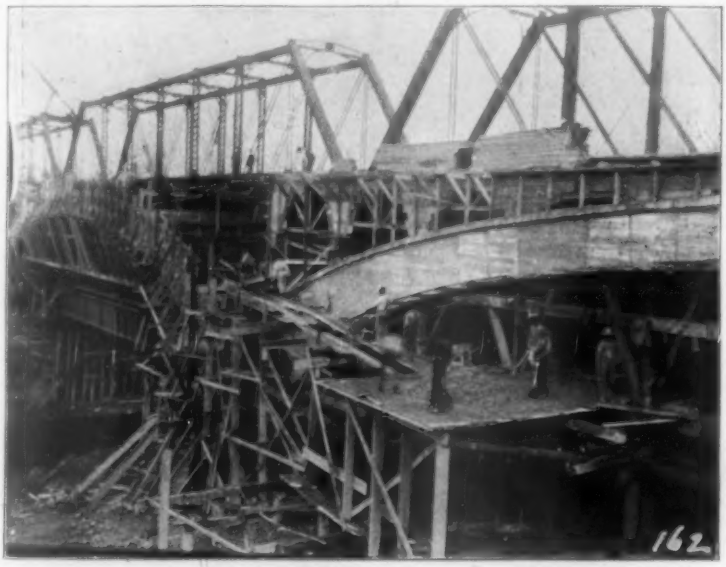
THE CONCRETE BRIDGE OF THE ILLINOIS CENTRAL RAILROAD OVER THE BIG MUDDY RIVER.

In May, 1903, the Illinois Central Railroad completed a bridge across the Big Muddy river in southern Illinois, made of concrete after designs and under the supervision of H. W. Parkhurst, its engineer of bridges and buildings, which has some very interesting features. The bridge consists of three arches, each of 140 feet span, resting on abutments at the ends 31 feet thick and two piers each 21.5 feet thick. The piers and abutments were built around old stone structures which carried the former iron truss bridge, by surrounding them with concrete. They were lengthened to suit the double track now required and widened so that there is a thickness of at least 6 feet of concrete outside the old stone work forming the center of each pier or abutment.

The main arches are of concrete, each being 140 feet span, 30 feet rise and 34.5 feet width. The total hight of the bridge is 50 feet and the length 574.5 feet. The main arch was built in sections so as to form voussoirs, similar to the stones in a masonry arch, except that each one extends the full width of the bridge. The order in which they were built was arranged to load the centering symmetrically, and when half through to show alternate blocks completed. The first pair of blocks made were the skew backs, the second at the quarters, the third each side the keystone, the fourth and fifth pairs divided the spaces between those already laid, the sixth, seventh and eighth pairs filled in the alternate single block spaces beginning nearest the abutment, and the last block formed the keystone. The arches were made as solid and rigid as possible. The first plate shows clearly the division of the arch ring into the sections described. It also shows the centering still in place. The maximum load carried by the centering during the construction of an arch was 3,000 tons, near-

ly 20 tons for each of the piles supporting it. The photograph shows the projection of the false work outside the face of the arch on which to support the forms for depositing the concrete and the platform for the workmen. Rather wet Portland cement concrete, requiring little tamping, was used, and a facing about 1½ inches thick of Portland cement mortar was deposited next the form at the same time.

The second photograph shows one arch with the arch forms still in place and one with the arch forms removed and



II. BIG MUDDY CONCRETE BRIDGE, ILLINOIS CENTRAL RAILROAD,

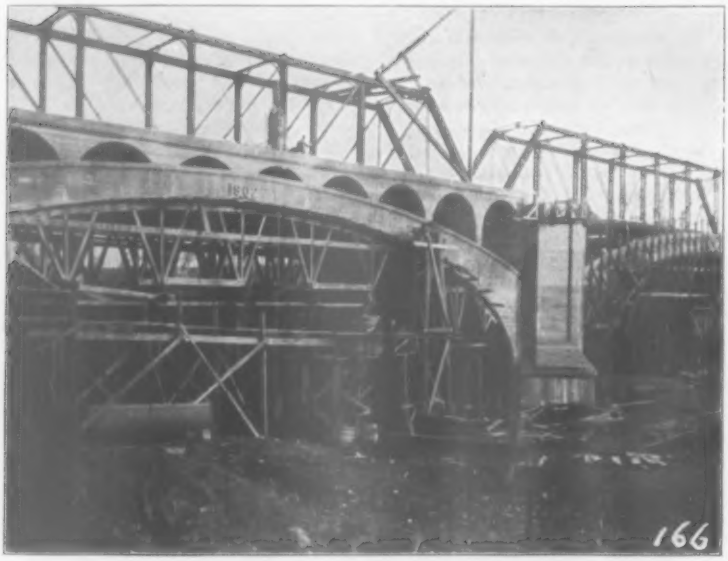
Showing Concrete Mixing Platform to Which Derrick Delivered Materials. Concrete Was Wheeled From Platform to Place on Pier Shown Under Construction.

the forms for the spandrel arches in place.

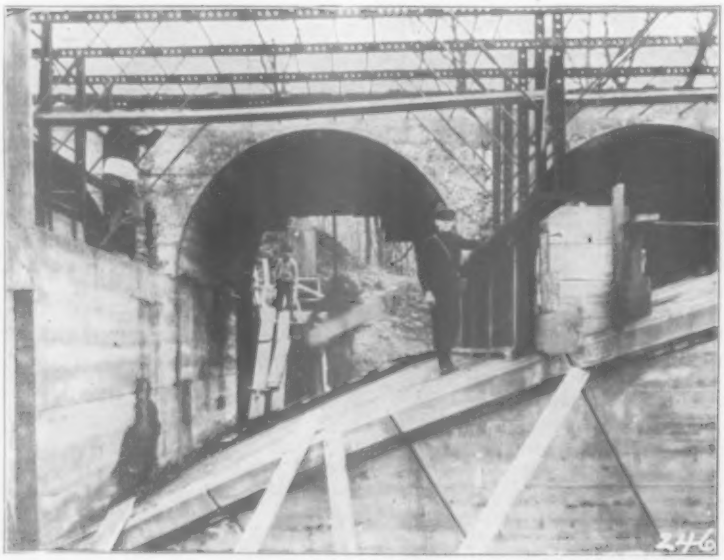
The base of the roadbed is about two feet above the highest point in the arch. The space between the level of the roadbed and the outer surface of the arch is filled in with spandrel arches as shown in the third view. This structure is a steel frame, a part of which is shown in the fourth view, surrounded with concrete. It is made as flexible as possible and an expansion joint is put in at each end of each of the main arches, or six in all. The section of each of the small spandrel arches is made a minimum to add to the flexibility under temperature stresses.

Each expansion joint extends from the haunch of the main arch up to the level of the roadbed. They are covered by the extension upward of the abutment and pier ends. The space for expansion is filled with several thicknesses of corrugated asbestos board which will compress and expand so as to keep foreign matter out, and sliding surfaces between the spandrel arch structure and the pier or abutment recess, in which the joint is constructed, are provided, also protected by asbestos board. The top of the joint is covered by a lead plate with its edges set in the concrete some inches back from each side of the joint. The plate is folded down into the joint two inches, forming a channel, which is filled with an asphalt composition, extending out to cover the entire lead plate. Observations showed a maximum movement at these expansion joints of 0.012 feet for a 140-foot span between January and May, divided almost equally between the two ends of the span.

The spandrel arches are true arches with the exception of the two at the center of each span. These are so low that the entire space is filled with concrete, with the exception of five feet at each face which is constructed in arch form for the architectural effect. This makes the total thickness of concrete at the center of the main arch seven feet,



III. BIG MUDDY CONCRETE BRIDGE, ILLINOIS CENTRAL RAILROAD,
Showing Completed Main Arch and Completed End of Spandrel Arches of North Span, and Arch Voussoir Molds in Place on Center Span.



IV. BIG MUDDY CONCRETE BRIDGE, ILLINOIS CENTRAL RAILROAD,
Showing Steel Framing for Spandrel Arches. Completed Section of Spandrel Arches in Background.

though the depth of the keystone is but five feet.

The roadbed was raised about five feet and the old bridge was raised to carry trains during the construction of the new one. This made it possible to construct the main arches completely in one operation. The spandrel arches for half the width of the bridge were then completed and trains run over that half. The old trusses were then removed and the spandrel arches were completed. This is seen in the fourth view.

The fifth view shows the east side of the bridge with the main arches completed. The general plan of the centering is shown in the nearby span, though much of it has been removed. The centering for the center span is shown supported on plate girders of 60 feet span over the water in the stream. There were 10 of these girders. At the time this picture was taken the spandrel arches of the west half of the bridge were completed and nearly ready for the passage of trains.

The total cost of the bridge was $125,000. The railroad company furnished and drove the piles, raised the old bridge and removed it, removed the falsework and cleaned up, laid the temporary track on the west half of the bridge and did many odd jobs at a cost of $34,402, under the unfavorable conditions of railroad work. The steel cost $4,451, crushed stone $7,200, $6,700 was allowed for engineering and sundries and the concrete contractor was paid $72,128. The cost of details is reported as follows: 5,000 cubic yards of excavation for fundations at 76 cents; 12,000 cubic yards of concrete at $4 to $10 a yard, averaging $5.43; 300,000 pounds of steel at 1.2 cents a pound and 0.61 cents for handling fitting and erecting.

We are indebted to Mr. H. W. Parkhurst for information and to the German-American Portland Cement Company, whose "Owlcement" was used exclusively, for the accompanying illustrations.

ASPHALT PAVEMENT MAINTENANCE.

By F. O. Blake, Cincinnati, Ohio.

Now that we have induced the property owners in our American cities to pay over $100,000,000 for asphalt paving, and as the period for which the contractor agreed to maintain it has expired on a large percentage of it, we are confronted with a new problem, that of maintaining it properly. This is a business proposition and must be met fairly and squarely by the city officers chargeable with such responsibilities, and much depends upon the result of their efforts.

The system thus far commonly used has been to contract with paving contractors to make repairs after holes have worn into the pavement, limiting the work, as near as possible, to the size of the hole, and to pay for the work performed by the square yard. There are many serious objections to this system. It is the wrong time to make a repair after a hole has developed, for it will then require 250 pounds of mixture for each square yard repaired, whereas it is possible to make the repair at a time when it can be done with ten pounds of new mixture. Again the item of measuring up the work is frequently a source of dispute and if the engineer or contractor in charge is arbitrary and does not allow enough to make the work profitable the contractor is apt to reduce the amount of asphalt used in the mixture or to adulterate what he does use.

The contractor must make it pay or go to the wall. An asphalt mixture can be produced for $2 per ton or it may cost $10 per ton, depending on the material used. It is a temptation for a contractor to use the $2 mixture in repair work, especially when he is not held responsible for the results; when it is to his interest to have the pavement go to pieces that he may reconstruct it. There are honest paving contractors, but human nature is weak and we are apt to consider our own selfish interests first when there is a conflict. This is not said to reflect on the integrity of the contractor, but to show that it is not to his interest to have a pavement everlasting and that his and the taxpayers' interests are not identical.

Along this line of reasoning can be found many explanations for the short life of asphalt pavement repairs. All this must change or asphalt paving will become one of the lost arts.

Thus far, no system of maintenance has been in use; repairs only have been made, and they in a manner to let the pavement drop one notch each year until it is beyond repair; then it is recon-

V. BIG MUDDY CONCRETE BRIDGE, ILLINOIS CENTRAL,
Showing the Three Main Arches Completed. Spandrel Arches Constructed After Steel Trusses Were Removed.

structed and the property owner is again called on to pay the bill. This system is wrong, and the political party in power must be held responsible for its continuance. Pavement should be maintained to a certain standard; it should be free from holes, waves, cracks or other defects; it should be as smooth as a billiard table. This condition is not possible under the present system of making repairs. Some system of constant renewal and of making repairs at the proper time must be adopted; the repair must be made when it is possible to make it with ten pounds instead of waiting until it requires two hundred and fifty pounds per square yard. By such a system it will be easy to maintain a pavement in perfect condition at less than half its present cost of maintenance.

I think the best results are to be had by adopting one of two methods; one is for the city to own and operate its asphalt mixing and maintenance plant, the other is to contract with competent parties to do the work by "force account."

The municipal ownership proposition has some good and many poor features. One advantage is that you are certain to get the material you pay for and as much as you need, and, more important than all other considerations, you can make the repair early and the pavement can be maintained to any standard desired. Such a policy will have the support of the property-owner and the public at large, but the opposition of the contractor whose interest it is to reconstruct. One objection to the municipal ownership proposition is that it requires skilled labor to operate it, one man of whom should be an expert and able to make chemical analyses and physical tests of the asphalt. Such men command large annual salaries and but a few cities have enough work to warrant the expense. Another bad feature about the municipal ownership plan is, that it is apt to become a political machine and be loaded down with political pensioners. Such a condition will give worse results than the present very poor system.

The advantages named above all apply to the second or "force account" proposition and it is free from the objections named. The "force account" proposition contemplates that the contractor shall furnish all machinery, tools, appliances, and the skilled labor necessary to do the work; the city pays all material and labor bills and the contractor is paid a reasonable per cent. on the gross amount for the use of his appliances and for supervision. By this proposition the city has no money tied up in machinery or tools, and receives the benefit of the expert labor without having to maintain a large salary roll. Asphalt pavement maintenance is now as much of a specialty as any other branch of municipal engineering and calls for a high class of ability and technical knowledge in this line.

Under this "force account" proposition, the city has complete control of the work, as much so as if it owned the plant. It pays for what it gets and no more. It is just to all parties. It is in the interest of the taxpayer and all others. It is one solution of the asphalt pavement maintenance problem.

ROAD MAKING IN BUXTON, ENGLAND.

By John Hatton, Mem. San. Inst., Assistant Town Surveyor.

Tarred macadam is attracting increased attention by reason of its hygienic properties, non-absorbent surface and low cost. Good roads are appreciated everywhere but perhaps nowhere more than in a health or pleasure resort. Buxton, the famous English Spa, early adopted tarred macadam. Situated in the heart of a limestone district the best possible rock is ready to hand. Tarred macadam is eminently adapted for the light business and carriage traffic of a non-manufacturing town. The even surface secures smooth running of vehicles, it is much quieter than ordinary dry macadam, wears longer, makes little dust and mud and if well laid does not form into caps and hollows. A tarred macadam roadway can be easily cleaned with horse brush and hose or water van; as a healthy road surface it competes closely with natural asphalt and, in that it is far less slippery during rain or fog, scores a point over the more costly roadway—but even tarred macadam is barely safe on a steeper grade than 1 in 20.

Tarred macadam presents good features for sidewalks. In roads overhung with trees its use avoids the unsightly and sometimes dangerous channels caused by water dropping from the branches. Water, whether from clouds or trees, runs off tarred macadam, and leaves it clean and fresh.

Limestone is one of the best rocks for tarred macadam. Granite is certainly a harder stone, but it does not absorb the tar to the same extent. An experimental length of roadway will soon show whether the right rock has been selected. Clean stone is essential to success. Clay, earth or even quarry sap proves fatal to good work and leads to rapid decay. The stone must be dry before being tarred and if slightly warm requires less labor in mixing and can be more evenly coated with tar mixture. Too great a heat, however, partially disintegrates the stone and renders it useless.

In Buxton direct labor is employed in all municipal departments. The tarred macadam works are under the control of Town Surveyor William Hedley Grieves, Hon. Fel. Inst. San. Engrs., Mem. San. Inst., etc., and produce by the sale of material a handsome profit for Highways Department.

The rock is quarried by gelignite blasting and run on an overhead tramroad to the crusher platform, where it is dumped. The crusher, driven by a water wheel, is fed from the platform and, after crushing, the stone is automatically screened into separate compartments. Nothing is wasted; the dust is used in place of sand in making concrete and for veneering tarred macadam sidewalks. From the screening bins the stone and gravel are barrowed to the drying shed, there to be thoroughly dried and slightly warmed on the hot iron floor. Even drying throughout a large heap of stone or gravel may be obtained by occasionally turning the mass over, but a greater depth on the drying floor than one foot is not economical. The drying shed floor is built of iron plates laid on low brick walls. All the plates are removable for cleaning and the spaces between the low walls form flues conveying heat to dry the stone above. A tar boiler, fed from the store tank, is under the same roof as the drying floor. Great care is necessary in boiling the tar to the right consistency. Unless the light oils are all expelled the macadam is soft and wears badly; if the heavy oils are also driven off by too long boiling the mixture is brittle. Three to four hours' boiling is usually required. One pound of pitch added to every 9½ pounds of tar produces a mixture which will form a water-tight cement on the stone and protect it from wear and weather. For half-inch limestone gravel 9.75 gallons of this mixture will be required per ton, for 1½ inch stone rather less, for finer gravel slightly more.

From the drying shed the stone is barrowed to the mixing plates, 4 feet by 4 feet sheet iron plates, laid in front of the store shed. One man brings a barrow of stone or gravel and dumps it on the plate, the tar man then pours a bucket of hot tar mixture over the heap and two mixers immediately follow and by repeated shovelings mix the stuff until every little stone is coated. The tarred macadam is then thrown to the store heap and kept in stock for three weeks or longer to allow the stone to become thoroughly saturated with the mixture. At the side of each mixing plate is a small coke fire, in which the shovels are heated from time to time. This prevents the tar sticking and lessens labor. The store shed floor may be either concrete, tarred macadam or iron plates, the latter in preference.

Power-driven machine mixers are desirable for very large consumers, but the method of hand-mixing described will be found economical for towns of moderate size.

Roadways are formed on solid rubble foundation leveled up to a true cross section and rolled. A 4-inch layer of tarred 1½-inch stone is laid on the rubble, raked even and rolled and this is followed by a 1-inch coating of tarred ½-inch gravel, and the surface is finally rolled. A 10-ton roller is sufficiently heavy for tarred macadam carriage roads.

Sidewalks are laid in a similar manner, except that the surface is finished with a ½-inch coating of tarred ¼-inch gravel laid on top of the ½-inch stuff. Each layer is rolled separately and the whole rolled finally with a one-ton manual roller. The dark appearance of sidewalks may be partly avoided by sprinkling the top coat before the final rolling with white or colored dry gravel, but this must be done sparingly or the advantage of tarred macadam will, in a great measure, be lost.

When the sidewalk gets worn slippery the surface should be thoroughly cleaned, floated with boiling tar mixture and sprinkled with limestone dust and traffic kept off until the tar has set. The mixture for veneering is the same as that used for making tar macadam. This process preserves the sidewalk and experience proves that it is economy to veneer immediately the surface shows signs of serious wear. If the top layer is badly worn the surface must be keyed with the pick and a new coating of tarred ¼-inch gravel laid and rolled. Roadways, when worn, need to be well keyed and the coating layer renewed.

Care is required to secure success in tarred macadam work as in all road mak-

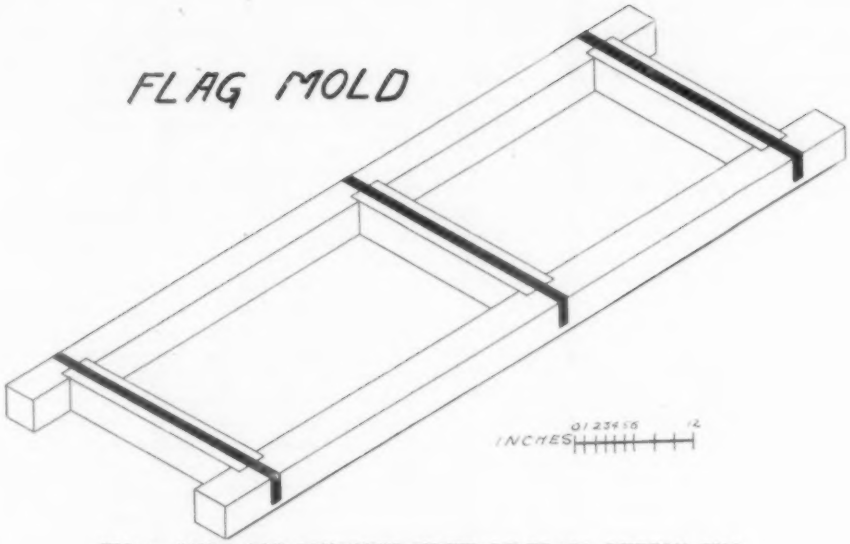


FIG. 1. MOLD POR CONCRETE SIDEWALK FLAGS, BUXTON, ENG.

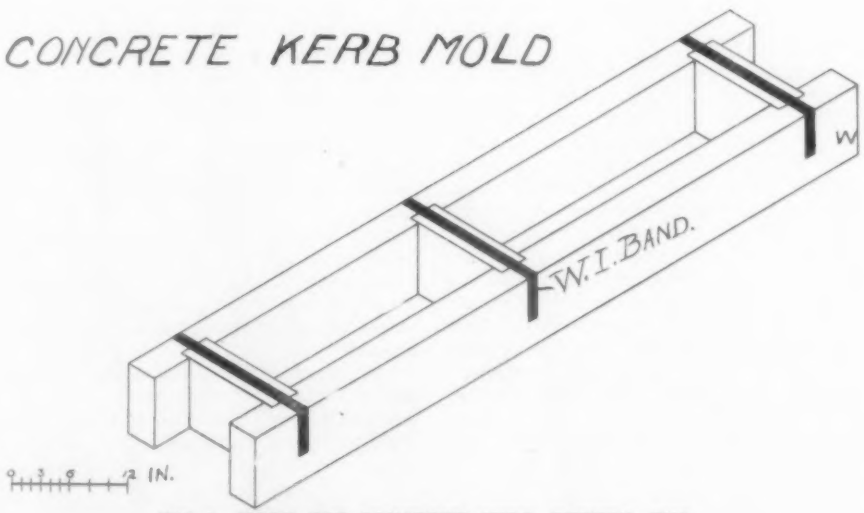


FIG. 2. MOLD FOR CONCRETE CURB, BUXTON, ENG.

ing. Rain, great heat or frost during laying is fatal to permanent work. A fairly warm spell with slight wind is the best time for laying tarred macadam. Thorough rolling is essential and if the material sticks to the roller water must not be used to get it off. A dry scraper gives the best results, although some engineers use creosote. Lastly, traffic should be kept off the road until the surface has set. Too early use leads to the formation of ridges and consequent rapid wear. Should the roadway be much cut up by the first few days' traffic it will pay to send the roller to smooth all down again before the surface has set quite hard.

Cost will naturally vary to a great extext in different districts. The tables below are taken from some recent cost sheets from the Buxton Works. Roadways average about half a dollar per square yard to form, exclusive of rubble foundation, and to relay the whole surface from 24 cents per square yard. Footways cost practically the same amount.

Cost of tarred ½-inch gravel at works:

5 men working half hour	$0.25
9.75 gallons tar mixture	.13
1 ton ½-inch limestone gravel	.74
	$1.12

Cost of Veneering Footpaths:

Manual labor, 80 hours	$ 8.20
Team labor, 10 hours	2.40
7.78 tons limestone dust, at .72	5.60
228.21 gallons tar mixture, at .07	15.96
Cost of veneering 1,000 sq. yds.	$32.16

Only just over three cents per square yard.

Concrete Sidewalks. Sidewalks in the main business streets of Buxton are paved with artificial flags manufactured by the Town Council employes. Finding natural flags costly and in some respects unsatisfactory, Town Surveyor William Hedley Grieves experimented with limestone gravel and Portland cement and, proving that a pavement of smooth surface, hard wear and about one-third the cost of York flag could be produced, advised his Council to adopt artificial flags for sidewalks. This paving is less slippery than natural stone and much more pleasant to walk upon. The flags were so satisfactory as to soon lead to the adoption of concrete curb and channel and now the paving in front of important public buildings and in main business thoroughfares is chiefly laid in this material.

Cab ranks, unless well paved and frequently swilled with a deodorant, are a prolific source of complaint. The many stands in Buxton are paved with impervious concrete block, manufactured in the same way as the flags, and can be easily kept clean and free from odor. The blocks are made fifteen inches square by three inches thick and cross-grooved on the surface to afford a good foothold for horses.

Limestone, from an adjoining quarry, is used entirely for the aggregate and Portland cement of first-class quality for the matrix. The crusher screen is arranged to give ¼-inch gravel and dust together, which is barrowed to the paving shop and mixed in the proportion of three of aggregate to one of Portland cement by measure. The molds are laid on a smooth floor, preferably of iron plates, sprinkled with limestone dust to prevent sticking and hand filled with concrete which is well worked down and the surface struck off and floated smooth. After setting for 24 hours the molds are taken off and used again. The flag remains on the floor for another day. It is then taken to the open stone yard and allowed to become thoroughly hard by maturing for six months.

The flags are made from 2 feet to 3 feet, by 1 foot 6 inches, by 2½ and 3 inches thick, and the curb 9-inch by 7-inch section in 2 feet to 3 feet lengths.

The molds are made in 3-inch pine with wrought iron straps across each end. Figs. 1 and 2 show molds for flag and curb.

All the sections are made in the same manner, thicker blocks requiring a proportionately longer time to dry and mature.

Figs. 3 and 4 show the construction of roadways and sidewalks in Buxton. Cab rank blocks are laid on 6 inches of lias lime concrete. Both sidewalks and cab ranks have the joints made in Portland cement.

The cost at the shop works out at about half a dollar per square yard for 2½-inch flag and the same sum per lineal yard for 9-inch by 7-inch curb.

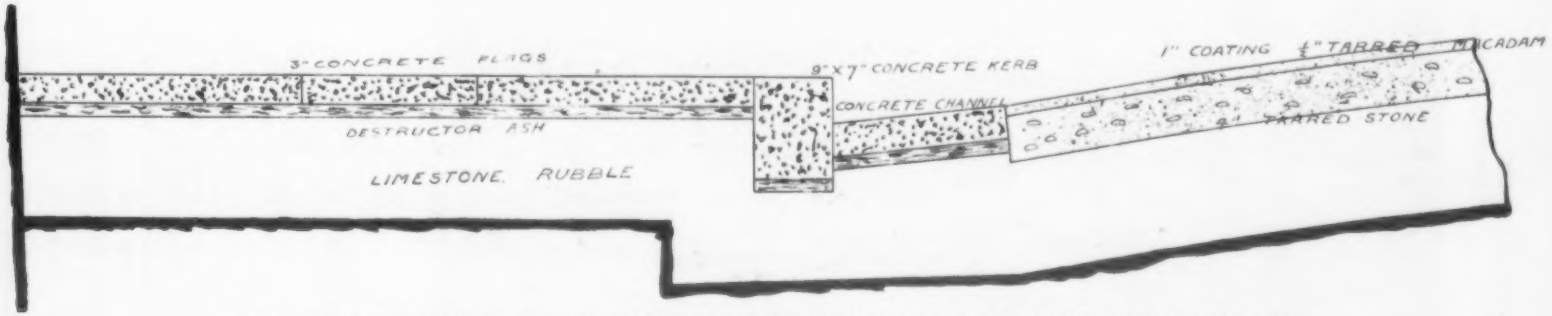


FIG. 3. CROSS-SECTION OF TARRED MACADAM STREET AND CONCRETE FLAG SIDEWALK, BUXTON, ENG.

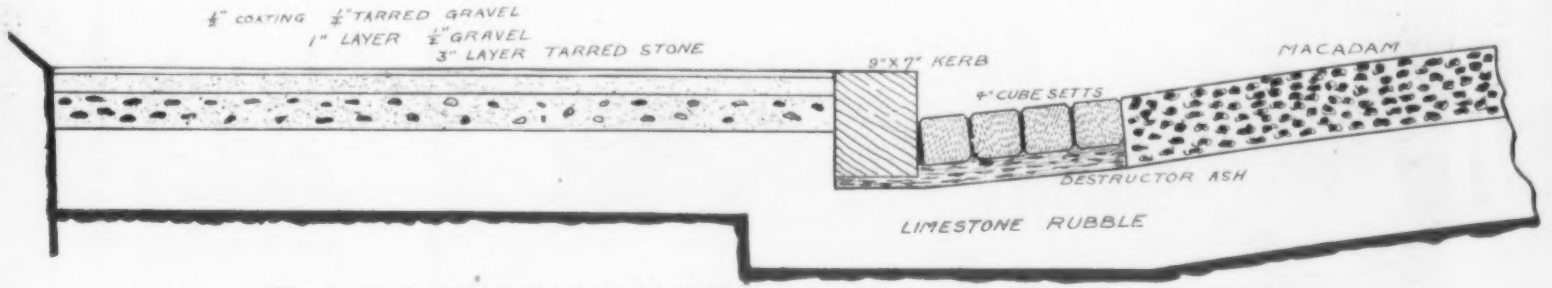


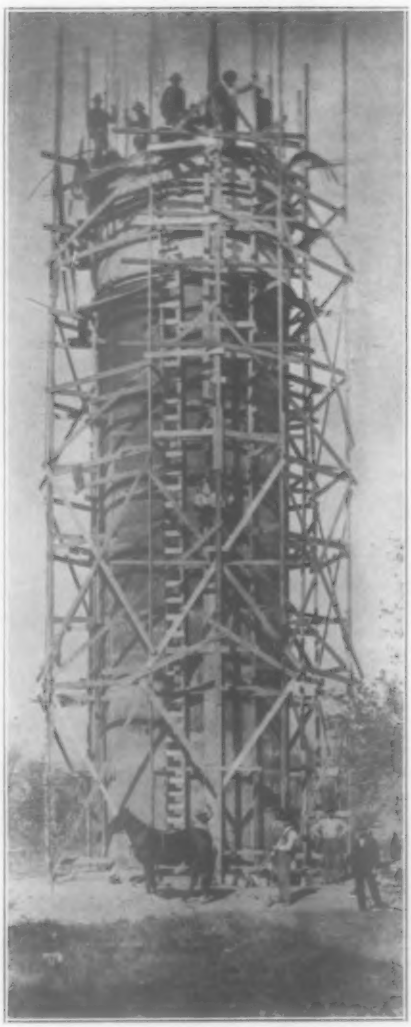
FIG. 4. CROSS-SECTION OF MACADAM STREET AND TARRED GRAVEL SIDEWALK, BUXTON, ENG.

THE CONCRETE STANDPIPE AT MILFORD, OHIO.

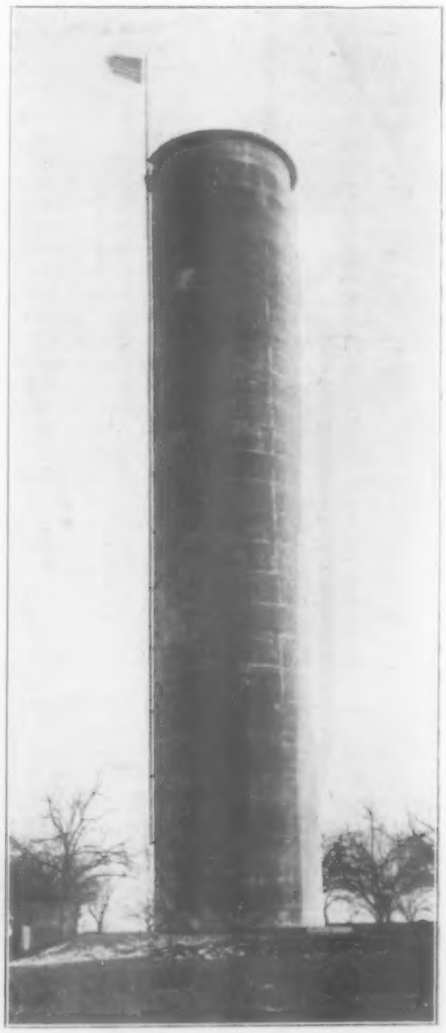
The accompanying cuts are taken from photographs of the Milford, O., standpipe which was recently constructed by Mr. J. L. H. Barr of Batavia, O., of steel concrete, under the Weber system.

The standpipe is eighty-one feet from the base to the roof. The roof has a spring of three feet, making a total hight of eighty-four feet. The outside diameter is fifteen and a half feet. The wall is nine inches thick at the base and carries that thickness for thirty feet, when it is reduced to seven inches and again at fifty-five feet it is reduced to five inches, the reduction being made on the inside each time.

The wall is reinforced with steel "tees" 1 inch by $1\frac{1}{8}$ inches set about three inches from the outer circumference of the wall, being placed both horizontally and perpendicularly, thus forming a net work of the steel. The horizontal tees are



Under Construction.



Completed.

MILFORD, OHIO, CONCRETE STANDPIPE.

placed closer at the bottom than at the top.

The intake pipe extends eighteen inches above the bottom of the tank, and the overflow pipe to within eighteen inches of the top, giving seventy-eight feet of available water space.

These pipes as well as the washout pipe are imbedded in the concrete foundation, which is six feet deep, of octagon shape with an inscribed diameter of twenty feet. The top of the base is troweled smooth and the standpipe proper is washed with neat cement.

The foundation is made of concrete in proportions one part cement to seven parts gravel. And the wall is one part cement to three parts clean sharp sand.

The forms were made of 1½-inch flooring three inches wide and cut to three feet in length for staves, and nailed to ribs 4x4 inches. The top rib extended one inch above the top of the staves forming a rabbet to receive the bottom of the next form when placed on top of it. Three sets of forms were used, each set consisting of an outer and an inner form, and each divided into eight sections for convenience in handling. These sections are held together by specially prepared latches.

A ladder extends from the bottom of the tank on the inside to the top and down again on the outside to within ten feet of the base.

The structure was completed without a pause or an accident of any kind.

This class of construction will evidently supersede steel for the same purpose, as the cost is about the same and they are practically indestructible.

EDITORIAL COMMENT

What is a Civil Engineer?
Municipal Program.
Fireproof Buildings.

WHAT IS A CIVIL ENGINEER?

The discussion over the Union Engineering Building and the apparent objection of many members of the American Society of Civil Engineers to leaving their present home for the new house to be occupied by the principal national societies, has brought into prominence the definition of Civil Engineering. The principal reason for this is the adherence of prominent engineers to the comprehensive Tredgold definition of seventy-five years ago, as the art of directing the great sources of power in nature for the use and convenience of man.

The name civil engineering was first assumed to distinguish it from military engineering, which was the first field to which the term engineering was applied. Military engineering may also be said to be included in the Tredgold definition, so that the Institution of Civil Engineers and the American Society of Civil Engineers are right in admitting military engineers to membership. In this country of peace most of the work of engineers of the War Department is strictly civil engineering in its classification.

In its early history all branches of engineering work then known were assumed by the civil engineer. One man could learn all that was known and have time to put in practice what he knew and add to the sum of knowledge. After a time the work of the civil engineers developed a class of men who operated the machines made necessary to aid him, and they in turn developed new applications of machinery and a special department of mechanical engineering which concerned itself mainly with the problems of machinery. These expert mechanicians and the engineers developed in the same special field became numerous enough to form a guild of their own and the profession of mechanical engineering was established. When electricity came, a further subdivision of mechanical engineering was made. These two sections are very large and are becoming larger. The mining engineers have developed a national organization of their own. The water works engineers, the gas engineers, the sanitary engineers, the municipal engineers, the bridge engineers, in some country or another have their separate organizations, most of them having special organizations in this country. The architect originally was a combination of architect and engineer. There has been a strong tendency to emphasize the artist in the combination to the detriment of the engineer, but modern architecture is emphasizing the engineering side, sometimes, unfortunately, to the exclusion of the artistic.

Each of these subordinate divisions of the engineering profession contains within its membership true engineers under the definition of civil engineering given, and also many experts in the technical details of the profession who are mechanicians, electricians, plumbers, draftsmen, surveyors, i. e., artisans, expert indeed, and thoroughly well informed, but not engineers, any more than the expert stone cutter who does the manual labor upon a statue is a sculptor.

There is room for a term which shall designate the true engineers in all these various professions, so-called, and will distinguish them from the great numbers of subordinate workers with which they are associated in their special lines. The time-honored term is civil engineering, and, while there might be a better, it is appropriate and may well be retained. The American Society of Civil Engineers followed the British Institution of Civil Engineers in this fundamental definition and should retain it. Its constitution makes the engineers in all the fields of mechanics, electricity, shipbuilding, mines, architecture, army and navy, eligible to membership. The mechanicians, electricians, ship carpenters, mine bosses, draftsmen, surveyors, drill masters and sailing masters have a proper place with the engineers in their various fields in the societies representing these various branches of engineering, but they do not become eligible to membership in the true engineers' society until they attain to the ability to "direct the great sources of power in nature to the use and convenience of man."

This is the principle upon which the

American Society of Civil Engineers is founded. If the society has departed therefrom in any degree it is because it has had a tendency to accept the formation of the societies in the special branches of engineering activity as complete and permanent separations from what is really the parent body. Its true position is that of central organization containing the master minds in all the other societies and aiding and fostering the development of each and all of them.

It represents the entire engineering professions, not what is left after electrical, mechanical, mining, military, waterworks, gas, sanitary and bridge engineers have been taken away.

These various branches of engineering, and others yet to come, form their special societies when they find the need of them, for a comparatively small number of the members are eligible to membership in the Society of Engineers and the new society is necessary to the further advancement of the profession. It does not mean separation from the parent society, but, on the other hand, should mean co-operation with it and extension of its influence and work.

The engineering profession began in a unity due to a lack of knowledge; it is now passing through a stage of diversity owing to the vast increase in knowledge and the opening possibilities of still greater advance; there are signs that it will return within a reasonable time to the unity brought about by a clearer understanding of the true meaning and value of the Tredgold definition.

THE MUNICIPAL PROGRAM.

One of the most important subjects which the National Municipal League has under consideration is what it styles the municipal program, and much of its most valuable work has been done in educating the public up to the advisability of the adoption of a well considered plan for municipal improvements, that the engineering features may be properly taken care of, that the artistic side of the individual structures may be fully developed and, what is still more essential, more likely to be neglected, that a well designed whole may be put up as the ultimate goal to be reached, so that all individual structures may be in accordance therewith and the full effect of all details be secured through their conformity to the organic whole.

The arguments for the municipal program are not wholly those of enhanced beauty of the city, though these arguments are certainly very weighty. In almost every case the argument drawn from cold cash is even stronger. The only difficulties in securing the acceptance of this argument have been the lack of knowledge of history by the ordinary municipal officials, and the necessity of paying for the preparation of the great plan. Though slight in comparison with the savings it will insure, the proximity of this expense and the fact that it usually does not apply directly to the construction of some immediate improvement conceal the greater benefits in the future. The penny-wise and pound-foolish proverb and the dollar concealing the sun are directly applicable.

Two recent disasters on very different scales give opportunity for the adoption of two municipal programs, and may serve as examples of the very different ways in which the principles may be applied, thus suggesting to other cities the possibilities in their own cases and the opportunities for originality in their programs and in the methods of carrying them out.

The first, and greatest, is the Baltimore fire. The city of Baltimore has been hampered in its development, as was the city of Boston, by the narrowness of the plan on which it was originallly laid out. Moreover, it has been very backward in the adoption of such improvements as sanitary sewers, modern pavements, electric wire conduits and transportation facilities. The wiping out of the business portion of the city with the exception of the handful of fire-proof buildings, gives an opportunity for the adoption of a comprehensive municipal program which has not been possible in any of the older cities since the Boston fire. The street plan can now be revised in the burnt district, which was the most congested business district, in accordance with the most modern ideas. There are no sewers nor pavements worthy the name which will interfere. The new sewer system, which has been so long under consideration, can easily be changed to fit the new plan, and the new streets can be paved with the best materials for their respective uses. At the same time it is possible to put in the new plan for the streets, the sewers, the conduits, and to follow them promptly with the pavements. The opportunity for making a new Baltimore is wonderful and questions of present expense and comparatively slight delay should not be permitted to stand in the way of the preparation of such a plan by experts in these lines. A general manifestation of public spirit equal to that

of a few of its citizens will insure vast future benefits to the city, the opportunity for which may otherwise be lost forever.

On a far smaller scale, the wholesale wrecking of bridges in Indianapolis by the spring floods has given that city an opportunity at far less expense, and with far less restriction on account of necessity for immediate rebuilding, to prepare and put up as a model to which to approximate, a comprehensive plan for bridges over the streams in the city and for the protection and beautification of their beds and banks. The division of responsibility for these improvements is greater in this case than in the much greater problem before Baltimore, and the education of the public at large is therefore still more necessary.

The newly formed Indianapolis Civic Improvement Association has taken the matter up, and, through its committee on bridges, has shown the desirability of a general plan for the improvements mentioned, and the ultimate economy of working to such a plan. The division of responsibility concerning the construction of a few bridges which are needed at the earliest possible moment may prevent the full consummation of the association's wishes, but the agitation is a popular one and will have a favorable effect upon such constructions as are now in contemplation.

There is scarcely a city which cannot form a municipal program upon some line between that of reform of municipal government on the plans of the National Municipal League, revising and rebuilding of the city, fortunately on a smaller scale than Baltimore finds necessary, improving and beautifying the city's waterways and their crossings as Indianapolis proposes, with great advantage to its appearance and nearly always with equal advantage to its municipal treasury.

FIRE-PROOF BUILDINGS.

The newspaper reports that fire-proof buildings burned in the Baltimore fire as readily as any others led to some investigation of the question, and while all the results have not been received at this date, enough have come to hand to show that the fire-proof buildings have come through the furnace in a condition far better than might have been expected. There were but six or eight such fire-proof buildings in the burned district, and they stand as strong evidence of the value of this method of construction. A few more such as those which passed through the fire with the loss of everything combustible in them and with comparatively little damage to the buildings themselves, and like the court house and postoffice, which, with the open spaces about them, prevented the spread of the fire in their direction, would have made a different story. This subject will be considered more in detail hereafter. It is desirable, at this time and at all times, that the practical success of fire-proof construction in such a fire be emphasized, and that the misstatements of the daily press with reference to them be corrected as promptly and as vigorously as possible.

THE QUESTION DEPARTMENT

BOOKS ON STEEL CONCRETE CONSTRUCTION.

Will you kindly give us a list of books published that treat on concrete construction in connection with steel and expanded metal?

GEORGENSON & PILLSBURY,
Fond du Lac, Wis.

This method of construction is so new in this country that there are no American books on the subject. "Experimental Researches on Reinforced Concrete" ($2) is a translation from the French of Considere which has recently been published.

There are many papers in the proceedings of various societies upon the subject and each of the firms introducing a special form of steel reinforcement has some scientific literature for distribution, which is usually written by engineers of ability and experience. Con-

sult the list under the heading, "Concrete-Steel Arch Bridges," in the "Business Directory" elsewhere in this number of Municipal Engineering. See the list of "Articles on Reinforced Concrete" in the answer to C. H. Sonntag's question.

ARTICLES ON REINFORCED CONCRETE.

As we have had several inquiries recently with reference to the application of reinforced concrete and the calculation of its strength, we should be pleased to receive a list of articles which have appeared in your magazine on this subject. C. H. SONNTAG.
Castalia, O.

The principal articles on the subject of concrete-steel construction which have appeared in Municipal Engineering are the following:

"Westvale Concrete Bridge," vol. xxii, p. 137; "Comparison of Stone and Concrete Arch Bridges," vol. xxii, p. 159; "Melan Arches in Indianapolis," vol. xx, p. 63; "Highway Bridges of Concrete," vol. xix, p. 388; in vol. xxiii, "Concrete and Melan Arches," p. 108; "Tests of Reinforced Concrete Beams," p. 126; "Concrete-Steel Bridges," p. 155; "Dimensions of Concrete Arches," p. 199; "A Small Concrete Arch," p. 477; in vol. xxiv, "Concrete Building Construction," p. 88; "Concrete-Steel Arch Bridges," p. 127; "A Few Applications of Concrete Steel in Building," p. 128; "The Melan Arch Patent," p. 191; "Concrete Sewers," p. 253; "An Application of Concrete-Steel Construction to Retaining Walls," p. 287; "Some Uses of Concrete," p. 422; in vol. xxv, "The Concrete Sewer on Northwestern-ave., Indianapolis," p. 182; "The Construction of the Sixty-inch Reinforced Conduits of Newark, N. J.;" in vol. xxvi. "Some Details of the Philadelphia Water Filtration Plants," p. 82.

There are many more articles on cement and on concrete without reinforcement.

WASH OR PAINT FOR CONCRETE.

I would like to know the best wash or paint to cover concrete work. Give me the proportions and kind of material.
F. B. PARKS,
Valparaiso, Ind.

The answer to this question will depend upon the necessity for the coating. A simple coat of whitewash, of lime with a little cement added, might answer for some purposes. The concrete may be painted the same as wood or iron if it is a front of a building or is the wall of a room. If a waterproof coating is desired and the wall was not finished with a coat of water-tight mortar when it was constructed, Sylvester's process may be used, applying first a coat of ¾ pound of castile soap to 1 gallon of water as hot as possible, rubbing to a lather with a stiff brush, and after 24 hours a second coat of ½ pound of alum to 4 gallons of water. Three applications of each coating alternately at intervals of 24 hours should make any surface waterproof. If none of these suggestions meet the case, the exact reason for the coat should be stated.

EFFECT OF OIL ON CONCRETE FLOOR.

I should very much like to know what effect lubricating oil has on cement concrete floors in machine shops, from some one who has had actual experience, together with the name and location of the shop. H. J. C., Cincinnati, O.

This question is referred to our readers. There are certainly many floors in machine shops and some of our subscribers can report their observations. The only report in Municipal Engineering is in vol. xxiii, p. 31, where tallow on a concrete floor made the surface quite porous. The top coat was made 1 cement to 1½ sand and a damp covering was kept on the concrete for a week after it was laid.

MAGAZINES DEVOTED TO CEMENT.

Can you give the addresses of magazines devoted to the work and materials of cement? J. H. HOOK,
Lancaster, Pa.

The principal magazines devoted to cement are first "Municipal Engineering" ($2), of Indianapolis and New York, whose publishers also issue frequent editions of the "Handbook for Cement Users" ($3), and the "Directory of American Cement Industries" ($5.)

"Cement," bi-monthly, New York.

"Cement and Engineering News," monthly, Chicago.

"Le Ciment," monthly, Paris, France.

"Cement und Beton," monthly, Berlin, Germany.

Others devoting a portion of their space to cement are:

"Rock Products," monthly, Louisville, Ky.

"Cement and Slate," monthly, Allentown, Pa.

"Thonindustrie-Zeitung," weekly, Berlin, Germany.

The American publications cover different parts of the field and there is none which attempts to cover it all. This magazine devotes the portion of its time

and space occupied by this subject to the practical use of cement in its various combinations and in the various classes of structures in which it is incorporated

BOOK ON CONCRETE BRIDGES.

Will you kindly let me know if the "Directory of American Cement Industries" for 1904 gives directions how to build bridges and other works of a similar nature? If not, what book would you recommend for giving such instructions, as I want to get a book on such works with specifications for the same.

JAMES WARREN.
Walkerton, Ont.

There is no American book on the subject of concrete bridges, which is assumed to be the subject of this question. The third edition of the "Directory of American Cement Industries" ($5), for 1904, does not include the handbook for cement users of former editions. It is omitted because it did not need immediate revision, and because the rapid expansion of the cement industry has greatly increased the size of the Directory. The "Handbook for Cement Users" is now published separately at a price of $3, and is the nearest what is asked for of any book now published. It gives the specifications for arch bridges of various kinds in concrete and in concrete steel and is a guide to the construction of such bridges, but does not consider the methods of determining the size and strength of the structures.

Many articles on the subject of arch bridges in concrete and in concrete-steel will be found in Municipal Engineering, some of which give instructions in detail for construction. All of the literature in English upon this subject is now in society proceedings and technical periodicals.

The design of concrete arches does not differ materially from that of masonry arches and the construction does not differ materially from that of any other concrete structure, so that there is nothing particularly new or strange to be met. The introducers of various methods of constructing concrete-steel arches and bridges present their own methods of design and construction in the advertising literature which they issue, and most designers of such structures follow their methods more or less closely. The list of names under "Concrete-Steel Arch Bridges" in the "Business Directory" on another page should be consulted, also the list of "Articles on Reinforced Concrete Construction" in answer to C. H. Sonntag's question.

HOW TO BUILD CONCRETE CHIMNEY.

I have a concrete chimney to build, 85 feet high, 3 feet of flue on the inside and walls 9 inches thick at top, 8 feet square at bottom, walls 18 inches thick, a square chimney. Can you give me any information regarding system of centering and construction?

B. V. H., London, Ont.

Reference may be made to the description of the construction of the concrete standpipe at Milford, O., elsewhere in this number of Municipal Engineering. The method of placing the concrete, and the method of putting up and removing forms can be used, whatever system of reinforcing or if concrete alone is used.

CONCRETE WALK WITH NATURAL CEMENT IN BASE AND PORTLAND CEMENT IN TOP.

I have just completed 18,000 square feet of cement floors, government work, under the following specifications: Base, three inches thick, one part natural cement, two parts sand and four parts gravel; top, one inch thick, one part Portland cement and one and one-half parts sand. Both the natural and Portland cements were tested and were accepted. The work was done according to specifications and to the satisfaction of the superintendent in charge. Now the top is beginning to separate from the base and the superintendent has condemned it and ordered it replaced. I have protested, as I contend that a bond cannot be formed between natural and Portland cements, owing to their different properties and manner of setting. (None of the work was frozen.) I protested before beginning the work, but you may know how useless that is under government specifications. I cannot give the scientific reasons why natural and Portland cements will not bond together, but I know by an experience of eighteen years in the business that they will not. I have also made inquiries of several contractors and they are all of the same opinion. I wish to show to the government superintendent the reasons why they will not bond together. If you can secure for me any information along this line it will be appreciated.

C. W. H., Omaha, Neb.

There are several very good reasons why a Portland cement top for a cement walk or floor cannot be guaranteed to keep its connection with a base made with natural hydraulic cement, though there are some cases where the combination has been made successfully.

In some instances the reason is a chemical one. The natural cement is very likely to have free lime and some brands

have large amounts of magnesia. The action of these substances is detrimental to Portland cement, and accounts for the inability of natural cement concrete to stand exposure to the weather. In case the natural cements are of this nature, a layer, perhaps exceedingly thin, of weak and granular concrete is likely to form between the top and the base. This prevents the intimate union of the two which is an absolute essential to a permanent walk, for the greater expansion of the top with an increase in temperature will soon separate the two on this plane of weakness. The swelling of the natural cement concrete from the action of the free lime, magnesia, etc., has an early tendency to disintegrate a thin slab such as a sidewalk or floor is, and this would have the same effect in separating the Portland cement top from it.

The two kinds of cement require materially different proportions of water, and natural cement is usually very quick setting as compared with good Portland cements suitable for sidewalk work. It is extremely difficult, and in some cases it is impossible, to get the top in place promptly enough to permit the base and top to set together, which is essential to the integrity of the walk.

It is sometimes claimed that the difference in the coefficient of expansion of natural and Portland cement concretes is the cause for the separation, but this troublesome difference in expansion is rather that between the top of the walk, which is open to the great changes of temperature from direct sun and heavy frost, and the base, which is protected from sudden changes in temperature and therefore expands and contracts much less and far more slowly. The same trouble in separation of top from base is found in walks and floors made entirely with Portland cement in case the base is permitted to set before the top is put on, or there is not complete combination of the two layers from any other cause.

The difference in chemical action of the two kinds of cement, the tendency of some natural cements to disintegration from chemical actions which are carefully provided against in the manufacture of Portland cement, the absolute necessity of a perfect bond between the two layers of the walk and an equality in their strength, are the true reasons for the very general failures of walks and floors made according to the method described in the question.

It may be suggested that the base and top of a Portland cement walk are not of equal strength on account of the differences in proportions of cement and sand, but many experiments have shown that there is much less difference in strength, especially under compression, than the differences in proportions would indicate, and what difference there is is far less than that between the natural cement concrete in the base described and the Portland cement concrete in the top.

It will probably not be possible to put a new top on the old base which will keep its place, because the exposure of the natural cement concrete has still further weakened it, and because it is almost impossible to put a top on a base which has set, so that it will keep its place. The chemical actions in the cement have probably been completed sufficiently not to interfere.

There are a few cases in which walks under such a specification have been successful, according to reports, though the writer has never seen a well authenticated case. The detrimental chemical actions were undoubtedly absent in these cases, the two layers happened to be well joined and probably the exposure of the walk or floor has been slight, so that the tendency to separation of the two layers has been smal. The word "happened" is used purposely, for the number of successes is so small and the reasons for them are so little known that the term is properly applied. The same may be said of successful attempts to put a new top on an old base.

COST OF CONCRETE SEWER.

We would like to know the approximate cost of a concrete sewer 6 feet in diameter with an average cut of 13 feet. Gravel costs $1 a cubic yard and Portland cement $1.50 a barrel on the line of the ditch and labor $1.75 a day. The trench is in hard clay, with very large boulders in the line.

J. M., Erie, Pa.

Perhaps our readers can give some idea of the cost of such a sewer from their own experience. Some figures from Washington, D. C., give the cost of excavation at 60 to 70 cents a cubic yard and concrete sewer complete at $7.50 a cubic yard in place. The cubic yards of excavation per linear foot of sewer are easily computed, and if the thickness of the concrete is given, the cubic yards per foot of sewer can be computed quite as readily. There is considerable variation in the bids on various Washington sewers on account of differences in conditions and in contractors, the bids for excava-

tion varying from 30 cents to $1.10 a cubic yard and for Portland cement concrete from $6.41 to $9.50. Cement cost $1.40 to $1.50 a barrel.

A TRENCHING MACHINE.

Can you give me the address of the manufacturer of the trenching machine described on page 275 of vol. xviii of Municipal Engineering. I have eight miles of farm drains to construct from 3 feet to 10 feet in depth and am looking for an excavator which will not mire in the soft ground. C. C., Danville, Ill.

The machine refered to was operated by John A. McGarry & Co., 189 Racine-ave., Chicago, Ill. Possibly the manufacturers named under the heading "Trenching Machines" in the "Business Directory" can supply a machine which will do the work. The revolving wheel machine of the Municipal Engineering and Contracting Company, used for digging water pipe trenches might be adapted to this work. Can our readers suggest any machines which they have found successful for this class of work?

CITIES PUMPING SEWAGE.

Our city is desirous of collecting information regarding pumping sewage from low levels into the gravity mains, and would be pleased to know the names of any cities which have pumping stations installed in connection with their system of sewerage.

C. H. TOPP
City Engineer, Victoria, B. C.

In Municipal Engineering, vol. xxv, p. 178 and vol. xxvi, p. 26, will be found a partial answer to this question, including Boston, Chicago, a large New Jersey drainage district, New Orleans, Providence, Madison, Wis., Pittsfield, Salem, Webster, Swampscott, and others in Massachusetts, Santa Cruz, and at one time, San Rafael, Cal. We will add to this list the names of other towns and cities in the United States or elsewhere which are sent us by our readers.

BEST METHOD OF GARBAGE DISPOSAL.

We are interested in the question of garbage disposal and I write to ask if you will kindly tell me which is the latest and therefore the most improved method, incineration or what is called the reduction process. M. R. CRANSTON,
New York City.

New processes and improvements on old processes occasionally appear and it is difficult to say at any time which is the latest improved system. Neither can it be said that all the so-called improvements are really such. The article on page 28 of the January number of Municipal Engineering is very favorable to the incineration process, but there are equally pronounced opinions in favor of reduction processes. The fact is that, like many other engineering questions, each problem must be solved for itself, and the process to be adopted for a given city must be chosen with due reference to the methods of collection of garbage, the customs as to separation of garbage and refuse, the danger of producing nuisance in the operation of the plant, the composition of the refuse and garbage, the possibilities of profit from the product of the works, etc., all of which are variables requiring special study for the determination of their probable values in any particular case.

The fact that the reduction works are all in the hands of private companies which seem to be operating profitably under their contracts with cities, suggests the value of these processes. The greater freedom from nuisance of many incineration plants is an argument in their favor. These are only two sample arguments, of which there are many on both sides.

Unfortunately the question of the proper disposal of garbage has never been considered to be an engineering question, which it really is, and there are very few instances in this country of adequate studies of the problem and thoroughly good plants well designed to fit the local conditions.

EXPANSION AND SAG OF STEEL TAPE.

What is the co-efficient of linear expansion for a surveyor's steel tape for each degree of increase or decrease in temperature. Fahrenheit, as recognized by the U. S. government as standard?

When dynamometer is used to compensate for sag in 100-foot steel tape, what is the necessary stress in pounds to be applied on dynamometer to correct for sag?

SUBSCRIBER, Seattle, Wash.

These questions are considered in detail in Johnson's "Surveying" ($4) in the chapter on city surveying and for still greater accuracy in the chapter on geodetic surveying.

The co-efficient of expansion of steel tapes varies from 0.0000065 to 0.0000070 for one degree Fahrenheit. Prof. T. C. Mendenhall, formerly superintendent of the U. S. Coast Survey, found an average of 6 or 8 tapes to be 0.0000059. Prof. Johnson recommends the use of 0.0000065 where the actual co-efficient is not known. It may

be determined when the tape is officially tested.

The proper tension to be used on a steel tape is such that the stretch due to it will equal the shortening due to the sag. The weight and length of the tape and distances between points of support are quantities which must be known in order to determine this tension. To determine the working tension, the pull when the length of the tape was tested must also be known. Prof. Johnson gives, as an example of the use of the tables and diagram which he has computed, the case of a 50-foot tape weighing 6 ounces on which the pull when tested for length was 5 pounds, and determines the pull to which the tape should be subjected as 9¼ pounds. In the case of a 100-foot tape weighing 12 ounces, with same pull at test, the working tension will be found from the diagram to be about 9⅝ pounds. Errors from weights greater will be less than those for less weights. The chapter on geodetic surveying gives methods of correcting measured lengths when the temperatures and tensions are measured, there being no attempt to make them exactly what they should be to produce the exact proper length of tape at time of measurement.

PLANS FOR CITY PARK.

You will greatly oblige me by sending me some plans for a city park 300 feet square, or the address of some one who can give the information.

J. L. N., Mitchell, S. D.

Municipal Engineering has not published any plans for such a park. Our correspondent is referred to the civil engineers whose names will be found under that heading in the "Business Directory" alsewhere in this number. Several of the engineers whose cards are in the advertising pages mention parks as one of their specialties.

BOOKS FOR A CITY ENGINEER.

Please give me names of books on estimates and report on street paving, sanitary sewers and road building.

W. H. GAINEY,
Valdosta, Ga.

Can you send me the titles of two or three of the best text books for city engineers, touching on his varied duties, and especially on the manner of constructing the work, the best materials, etc?

CLAY STACKER,
Clarksville, Tenn.

There is no single book covering the ground desired. McCullough's "Municipal Public Works" (50 cents) is an excellent little discussion of the problems coming under its title, but it is necessary to go for detail to books devoted to paving, sewerage, bridges and other special branches. Quite a full list of books under each subdivision of the city engineer's work in an article entitled "A City Engineer's Library" in this department, in vol. xxiv, p. 277.

ENFORCEMENT OF HOUSE NUMBERING ORDINANCE.

Our city has passed in due form and regular enactment an ordinance for the numbering of the buildings, providing as follows:

"Sec. 3. The owner or owners of all improved and occupied lots or parts of lots shall have posted in a conspicuous place on some building thereon such numerals as correspond with the number of such lot or part of lot, and as shall be furnished them by the City Engineer.

"Sec. 4. Any person neglecting for sixty days after having been notified by the City Engineer or City Marshal of the numerals to be placed upon his or her property, shall upon conviction be liable for a fine in any sum not exceeding $10, and moreover, the city may place upon his or her property such numerals as required, and file an itemized cost of same with the County Clerk, and such shall be added to the levy as a special tax, and shall be a lien upon the property collectable as any other tax."

I do not find anything in the statutes of Nebraska authorizing such a law, and the question is: Can it be enforced?

J. P. HAZARD.
Alliance, Neb.

The numbering of houses is a police regulation. It is a necessary regulation for cities and can be enforced as other police regulations duly established by ordinance are enforced.

Possibly the courts would take cognizance of any unreasonableness in such an ordinance and require modification on this account, but the principle of the ordinance would undoubtedly be upheld.

TESTING WATER METERS.

Will you please give me some information through your question department about testing water meters?

JOHN J. WEIR,
New Glasgow, N. S.

In the Journal of the New England Water Works Association for Dec., 1903, will be found an article on testing some 6-inch water meters which probably gives the information desired. The tests were made:

First. To determine the loss of head or retardation of flow by the passage through them of varying quantities of water, say from 25 cubic feet per minute

to as large an amount as would flow under the conditions resulting, possibly as high as 300 to 400 cubic feet per minute in some types of meters.

Second. To determine how small a stream each meter would register, and with what per cent. of slip or leakage, or, in other words, what the unrecorded flow will amount to on various discharges, from the smallest stream possible to register, as well as their accuracy on various-sized streams up to their capacity.

Since the meters were large, special arrangements were made for getting rid of the water. The ordinary fire hose nozzle was used to measure the amount of water passed, using Freeman's tables of pressures and discharges. Pressure gauges on each side of the water showed the loss in pressure in passing through the meter. This varied greatly with different meters and the results are shown in detail in the paper.

For the second class of experiments the water passing the meter was weighed and the volume thus obtained was compared with the meter reading to determine the error in the meter.

Mr. John W. Hill has a paper on a comparison of water meters in the transactions of the American Society of Civil Engineers for 1899 which has some valuable information on the subject. If our correspondent will be a little more definite as to his wants they can probably be filled to his satisfaction.

INDEX TO MUNICIPAL ENGINEERING.

I have not the liberty to make a card index to Muncipal Engineering, which would make the files more available. Are there not many subscribers in the same position? Why cannot you make and publish an index of all the volumes to date and then issue supplements every five or ten years? I think it would meet with ready sale. If you do not care to venture on the experiment, a note in the magazine that such an index would be issued if a sufficient number would subscribe for it would determine what is the desire for it.

J. WALTER ACKERMAN,
Auburn, N. Y.

Mr. Ackeman's note is published as others similar have been published before to see whether any considerable number of our subscribers desire such an index. The response to former statements of this sort has been so very slight that the publication of the index has been postponed. The editor has a card index for office use which can easily be prepared for printing in book form and the index can therefore be issued at comparatively small expense if it is wanted. It is open to subscription and will be printed if any reasonable number of responses are made to this call.

BOOK ON BRICK PAVEMENTS.

What is the best book you have on brick pavements, including formulae for estimating on such work?

U. G. STOCKWELL,
Albany, N. Y.

Baker's "Roads and Pavements" ($5) has the best treatment of the subject of brick pavements and includes data for making estimates of quantities and cost.

NEW YORK CIVIL SERVICE EXAMINATIONS.

In your September number of 1903 there is a notice of New York City civil service examinations for inspectors of municipal work. I should like very much to get a copy of these examination papers. Can you tell me how to secure them?

JAMES H. TURNER.
Zion City, Ill.

A letter addressed to the secretary of the Board of City Civil Service Commissioners, New York City, would probably secure copies of sets of examination questions which have been used.

SHELL ROAD AS FOUNDATION FOR BRICK PAVEMENT.

Will you please give me, through the columns of Municipal Engineering, your opinion as to whether shell streets are a good foundation for brick pavements in a town of six or seven thousand inhabitants. It has been said by some authorities that these shell streets will make a good foundation for brick pavements by putting a coat of sand on the shells and filling in the joints with brick. These shell streets are very uneven and in order to have the sand of uniform thickness it would be necessary to do quite a great deal of leveling, which would be very hard to do, and the places filled in would, of course, be much softer than those that are not disturbed, and it seems to me that this might be a serious objection. It has also been said that in case that proves an objection that the streets might be plowed up and rolled, but I know of no power accessible to the town without great cost, with which these streets could be plowed up—it certainly cannot be done with teams, because the shells are closely packed and it is very tedious work with a pick to pick them up.

P. S. SHOCKLEY.
Salisbury, Md.

The shell road would make the best of foundation for a brick pavement with the exception of the unevenness of the surface and possibly the excessive crown of

the shell road. The latter may not occur, since the road may be worn down to a reasonable crown for a brick street.

A roller will be necessary in getting the roadway into shape for the brick and in settling the brick. Spikes may be set in the rim of the large wheel, which will loosen up the surface of the street and picks can then get hold of it. A scarifier is advertised by Julian Scholl & Co. which would seem to be the proper instrument for removing the unevenness of the street. It tears up the surface just enough for this purpose. It can be hauled by the steam roller and used either with or without the spikes on the roller wheels, as seems to be necessary. The loosened material can then be spread with pick and shovel and objectionable parts removed, the surface again rolled to uniformity and the sand cushion and brick then put in place.

REMOVAL OF SNOW FROM STREETS.

Can you give me any references to machines for melting snow in the streets?

G. W. BORTON, Philadelphia, Pa.

The daily press had some notice of a machine for melting snow from city streets, but it seems to have disappeared. A little computation of the heat which would be necessary to remove any appreciable amount of snow, and a consideration of the difficulty of getting the water into the sewers before it could freeze, gives an idea of the difficulties in the way and of the reasons for failure of any chance apparatus for this purpose.

A more feasible suggestion is that made by a correspondent in Municipal Engineering, vol. vi, p. 53. He would lay steam pipes under the gutters which would be of material not injured by the heat. The snow in the gutters would melt and run to the catch-basins and the snow could be scraped from the street into the gutters as rapidly as it disappeared from them. The large amount of heat required would make this a slow process, but it would be more rapid than the machine and would keep the melted water running to the sewer.

Detroit dumps snow into the nearest sewer manhole or large sewer, as described in vol. xxii, p. 44. The removal of snow from New York streets by carts is described in vol. xii, p. 38.

BRICK ROADS IN RURAL DISTRICTS.

Can you give me any information as to construction of brick roads in rural districts? We would like to find out where such roads have been laid and construction of same; also how they are wearing, and what kind of satisfaction they are giving.

A. M. COBBE,
Jamestown, N. Y.

In the proceedings of the Ohio Society of Surveyors and Civil Engineers for 1902 will be found a paper on "Paving a Country Road," by Sam Huston, C. E., of Steubenville, O., who describes a road 10 feet wide laid on one-half a roadway, leaving the other half for use in good weather. The roadbed is thoroughly drained with all the necessary transverse and longitudinal drain tile. A curb of vitrified clay is set at each edge of the brick and flush with its surface. The drain trenches were filled with 2½-inch fragments of vitrified clay, waste from tile factories, and a 6-inch layer served as foundation for the brick. The sand cushion was one inch thick. The itemized cost was as follows for 5,479 feet, slightly over one mile:

Excavation, 10,334 cu. yds.	$1,240.08
Overhaul, 47,490 cu. yds.	474.90
Grubbing trees, 18	18.00
4-inch sewer pipe, 8,012 ft	480.72
Curbing, 10,784 ft.	2,156.80
Foundation, 3,413 cu. yds.	750.86
Paving, 6,243 sq. yds.	3,246.36
Total	$8,367.72

Can our readers give other examples in detail of this class of work?

MUNICIPAL MATTERS IN COURT

Higher Courts—Cicero Water Rates—Venezuelan Asphalt Suit—Non-Abutting Lot Assessments—Park for Water-Works—Bay State Gas Co.—Bitulithic Infringement Suits—Chicago's 75-cent Gas—Defective Water Supply—Chicago Debt Limit—Contaminated Water Supply—Destroying Public Property—Illinois and Michigan Canal.

Abstracts from Decisions of the Higher Courts on Matters Relating to Municipal Improvements.

Prepared by Russell T. Byers, LL. B., Indianapolis, Ind.

Assessments—Validity—In Duluth, petition for local improvements must contain the names of a majority of the property-owners to be affected. This provision is jurisdictional and until complied with confers no authority upon the Council to act.—Hawkins vs. Horton et al. 97 N. W. Rep. (Minn.) 1053.

Reassessing Benefits—Equal Rate of Assessment—The Portland City charter provides that the Council may reassess benefits on an equitable basis when the original assessment is invalid. This section is retroactive in effect. The state constitution, Art. 9, Sec. 1, requiring an equal rate of assessment and taxation does not apply to the assessment of property for local improvements.—Kadderly et al. vs. City of Portland et al. 74 Pac. Rep. (Oregon) 710.

Local Improvements—Front Foot Rule—Collateral Attack.—Though a resolution to make improvements be not passed by a two-thirds vote of the Council, if the requisite number vote to enter into the contract for that specific improvement and the assessment be duly confirmed, the assessment is not open to collateral attack in a suit brought for the collection of the assessment. The application of the "front foot rule" is not ipso facto an arbitrary assessment of damages. In the absence of a showing to the contrary it will be presumed that the property was benefited to the extent of the assessment, nor may this determination of benefits be attacked collaterally.—Brown et al. vs. Central Bermudez Company. 69 N. E. Rep. (Ind.) 150.

City Sewer Assessment—Debt Limit—At the date of the passage of the ordinance authorizing the construction of the sewer, and at the time of entering into the contract for the same the borough's indebtedness was less than the 2 per cent. limit. The contract imposed no liability on the borough, but viewers afterward assessed a part of the cost against the city. Subsequently, and before the bonds to pay for the sewer had been issued, ordinances were passed authorizing other expenditures and bonds to pay for same. These, with the original indebtedness and the cost of building the sewer, exceeded the 2 per cent. limit. Held, that the mere passage of the subsequent ordinance did not create an indebtedness, that the obligation for the sewer was prior to any arising under such subsequent ordinances and that the indebtedness incident to the construction of sewer did not increase the debt beyond the 2 per cent. limit. Redding et al. vs. Esplen Borough et al., 56 Atl. Rep. (Penn.), 431.

Sidewalks, Grades and Assessments—Publication of Corrections—When the ordinance providing for a sidewalk declares that it shall be constructed on a grade established by an ordinance then on file, and such grade establishing ordinance was really passed and approved the same day as the sidewalk ordinance, there is no such inconsistency as will avoid the assessment, the grade ordinance being sufficiently identified to give notice of the grade. The fact that an ordinance does not provide what shall be the exact number of "property crossings" does not render it void for uncertainty. Where an error is made in the ordinance as to the size of the brick to be used and an amendatory ordinance correcting this is sufficiently published, it is not necessary to republish the original ordinance when otherwise sufficiently published. People ex rel. Rice vs. Burke, 69 N. E. Rep. (Ill.), 45.

Unreasonable Ordinance Invalid—Destroying Street Improvement—Where a

city has general power to legislate on a given subject, an ordinance relating to such subject, if unreasonable, unjust or oppressive, is invalid. Where a macadam pavement has been in place less than four years, is in good condition and there is no reason for removing it, an ordinance requiring it to be torn up is void. City of Chicago vs. Brown et al., 69 N. E. Rep. (Ill.), 65.

Council's Power to Assess—Council does not have power to assess property not assessed by the commissioners. Spring Steel & Co. vs. City of Anderson et al., 69 N. E. Rep. (Ind.) 404.

Damage from Changing Grade—In an action for damages, incident to a change of the street grade, is is no defense that the plaintiff bought the property with knowledge that the improvement had been ordered. One of the items of damage is the reasonable cost of grading plaintiff's front lot as being an item of special damage. Improvements made by neighbors are not items of special benefits. Pickles vs. City of Ansonia, 56 Atl. Rep. (Conn.), 552.

Modification of Improvement Resolution—Public Hearing—Voting to abandon the improvement provided for in the first resolution and directing the engineer to prepare a second estimate which was subsequently modified by substituting a different material and a cheaper method of construction, is not such an abandonment as to make a second hearing necessary. McChesney et al. vs. City of Chicago, 69 N. E. Rep. (Ill.) 82.

Revocation of Permission to Use Streets—Where the right to revoke permission to use city streets for laying electric light conduits exists, by virtue of reservations in ordinances, it may be exercised by the legislature. Boston Electric & Co. vs. Boston & Co., 69 N. E. Rep. (Mass.) 346.

Vacation of Streets—The town council had power to vacate a public street, but only for the public benefit. An ordinance providing for vacation of a street for the benefit of a private individual is void. An ordinance of a town council ordering in general words, the reduction in the width of a street from forty to fifteen feet is void for uncertainty. Pence vs. Bryant et al., 46 S. E. Rep. (W Va.) 275.

Vacation of Streets—The statute relating to vacation of streets is applicable to the vacation of one side of a street. Where such vacation takes place over the objection of property owners it is void and subject to collateral attack. Lowe et al. vs. Lawrenceburg et al., 69 N. E. Rep. (Ind.) 148.

Cicero Water Rates Must Be Same as Chicago's.

The Supreme Court of Illinois rendered a decision Feb. 17 in the case of the town of Cicero vs. Chicago, in which it held that under the sanitary district act Cicero is entitled to pure water at the same rate Chicago pays. The town filed a petition in the Circuit Court of Cook county for a writ of mandamus to compel the city of Chicago to furnish the people of Cicero with pure water at the rates prevailing in Chicago. The town set up the sanitary district, claiming it was a part of the district and had paid its share of the taxes to construct and maintain the canal, the object of which was to furnish pure water to the people of the district. Among other things the court holds that the Legislature had no right to change the boundaries of the sanitary district so it would take in additional territory.

Venezuelan Asphalt Lake Suit Decided.

The Federal High Court at Caracas, Venezuela, has handed down a decision holding that the claim of Warner & Quinlan of Syracuse, N. Y., to possession of the Felicidad asphalt mine, a portion of the asphalt lake in the State of Bermudez, claimed also by the New York and Bermudez Asphalt Company, which holds a concession to work the lake, is null and void. The court bases its opinion on the argument that, while the concession of the Bermudez Company was valid, no claim to the Felicidad mine could be granted. The Felicidad mine was bought in 1898 by Warner & Quinlan.

Liability of Lots Not Abutting on Street.

The meaning of that section of the Barrett law which provides for assessing the cost of a street improvement against the property lying back from the street, but within 150 feet of it, in case the abutting property does not sell for enenough to pay the expense, was argued before the Indiana Supreme Court, at Indianapolis, February 17. The suit came from Kokomo. William H. Voris sued the Pittsburg Plate Glass Company on some street improvement bonds that were issued ten years ago and purchased by him. No assessment was levied on the company's property, and it was not until after Voris had forclosed his lien on the abutting property and it has been sold that he set up a claim to the property

lying behind it. The attorneys for Mr. Voris rely on the construction which they give to a clause in the statute providing that if the abutting land does not sell for enough to pay an assessment all land within 150 feet of the street shall be subject to sale. The appellee's attorneys insist, however, that this applies only in case immediate steps are taken by the contractor to enforce payment, and an assessment is duly levied on the back property.

In this case no assessment was made against any property except the abutting lots. The attorneys also insist that Barrett law bonds can only be issued after a final assessment has been made and after the owner of the property assessed has signed a personal undertaking to pay the assessment, whether the assessment is legal or not. They argue, therefore, that the purchaser of bonds must be regarded as having taken the personal obligation of the abutting lot owner, secured by a lien on his property, and is not in the same situation as the contractor was before bonds were issued.

City Enjoined from Using Park for Water Works Station.

A decision was rendered recently by Judge Joseph A. Gill of the United States Court at Vinita, Ind., Ter., on the question of the right of an incorporated town or city in the Indian Territory to use its parks for public works. The attempt of the municipal authorities to erect a standpipe, reservoir, power house, tanks, etc., in the North Park of the city of Vinita for the purpose of constructing a water works plant and a sewerage system brought out the decision. The city had awarded the contract for constructing the water works plant and the contractors were ready to go to work when property-owners facing the park where the plant was to be erected filed an application for an injunction against the city and the contractors to prevent them from using the park for that purpose. The decision sustained the property-owners in their contention.

Bay State Gas Company's Reorganization Troubles.

Judge Kirkpatrick of the United States Circuit Court denied, Feb. 9, the application of Frederick B. Brackner, counsel for George W. Pepper, receiver of the Bay State Gas Company of Delaware, to make George B. Hallock, receiver of the Bay State Gas Company of New Jersey, a co-plaintiff in a suit now pending in the supreme judicial court of Massachusetts, wherein Mr. Pepper seeks to set aside the sale of $11,000,000 worth of bonds made last July upon the reorganization of the New Jersey corporation. The court allowed Mr. Hallock, however, to be made a party defendant in the suit in order that he might defend his action in bringing about the reorganization and the subsequent sale of the bonds. It was agreed that this act should not be considered in any way as casting discredit upon Mr. Hallock's action as receiver of the New Jersey corporation. Mr. Hallock's counsel opposed the application on the grounds that his client had acted in good faith in all his acts as receiver and any sales that he made or brought about were solely in the interests of the stockholders. The counsel for the New Jersey corporation declared that the purpose of the application was only to harass the local corporation and its receiver. He contended that the application to make the receiver for the New Jersey corporation a co-plaintiff in the suit would, if granted, not only bring discredit upon the receiver himself, but upon the court as well, for Mr. Hallock had been appointed by him.

Suit for Infringment of Bitulithic Patents.

Warren Brothers Company of Boston, Mass., have instituted suit in the United States Court at Grand Rapids, Mich., against the city of Muskegon, Mich., to recover damages, alleging that a bituminous macadam pavement recently completed in that city by the Barber Asphalt Paving Company is an infringement of patents. A similar action is pending against the city of Owosso.

Chicago Cannot Have 75-Cent Gas.

A decision was rendered by Judge Grosscup of the United States Circuit Court at Chicago, Jan. 25, against the city of Chicago in the 75-cent gas cases. He declares that the state did not delegate the city the power to regulate the price of gas. The decision was rendered in the case of D. O. Mills, as stockholder in the People's Gas Light and Coke Company, and Frank G. Jones, as stockholder in the Northwestern Coal and Coke Company, asking for injunctions restraining the city from reducing the price of gas to 75 cents. Both injunctions were granted.

Ukiah City Cannot Collect Damages for Defective Water Supply.

The Supreme Court of California rendered a decision Feb. 11 holding that Ukiah City is not entitled to damages from the Ukiah Water and Improvement Company by reason of the losses sustained by the former at a fire where the water supply did not prove adequate. The municipal authorities allege that the corporation was under contract to furnish a sufficient supply of water for fire-fighting purposes. The Supreme Court holds that there was no express covenant in the contract providing for any special quantity or pressure of water, and cited numerous cases similar to this one showing that no damages may be obtained unless the terms of the contract specially provide for services which are not given in the emergencies where losses are sustained. A jury in the lower court rendered a verdict in favor of the town, but the judge granted a new trial and an appeal was taken from his order by the plaintiff. The Supreme Court sustains the judge of the lower court.

Chicago's Debt Limit.

The Illinois Supreme Court has rendered a decision giving the city of Chicago the power to issue bonds up to $20,550,000, which is 5 per cent. of the assessed valuation of the city—the debt which the city can assume under its constitution. World's Fair bonds of $4,511,000 are held to be outside of the city's bonded indebtedness, and the sinking fund reserve is $1,049,000, and is by the court credited against the bonded debt, reducing it by that amount. The special assessment debt for public improvements, amounting to $2,000,000, is not included in the bonded indebtedness. The city, therefore, has the right to immediately issue bonds to the amount of $20,550,000 for any corporate purpose. The entire indebtedness of the city at the present time is $15,980,000 and the outstanding judgments not provided for amount to $4,871,182. As soon as the bonds are issued these bonds will be paid in full and the debt paid.

Damages Sought for Contaminated Water Supply in Ft. Wayne.

The grand jury at Ft. Wayne found contaminated water in the mains recently and indicted three water works trustees and the Pennsylvania Railroad Company on the charge of committing public nuisance. The Pennsylvania Company, which gets its water from the river, but uses the city water when the company pumps are out of order, forgot to turn the valve and pumped river water on high pressure into the city mains through a secret connection which was made during another administration.

Village Board Indicted for Destroying Public Property.

The members of the village board of Harmon, Ill., were arrested recently on warrants sworn out by property-owners on charges of destroying public property. The board had built a cement walk before the store of George and John Swartz. The firm refused to pay for the walk, and it was torn up by order of the board. A man conducting a saloon in the Swartz building petitioned the board for an extension of license. On the ground that he was occupying the Swartz building the board refused the license and proceedings were then instituted against it.

End of Illinois and Michigan Canal.

The Illinois Supreme Court handed down a decision Feb. 17 directing the Sangamon County Circuit Court to enjoin the canal commissioners from drawing any part of the last appropriation of the General Assembly. Representatives L. Y. Sherman and Richard E. Burke of Chicago made a fight in the last General Assembly against a bill appropriating $152,950 for maintaining the canal and operating the Bridgeport pumping station. Mr. Burke's contention was that such an appropriation was in direct violation of a provision of the state constitution which prohibits appropriation of public moneys for the maintenance of railroads and canals. He was granted a temporary injunction in the Circuit Court, but on hearing Judge Creighton dissolved the injunction. The Supreme Court's decision sustains Mr. Burke at every point. The opinion sets out in detail its answer to the contentions of the appellees, as follows:

The court gathers that the constitutional content of the provision relating to the canal was that the power to sell or lease the water way should remain with the people, and the management, if that shall seem wise and best, should be possessed by the Legislature, to which power of management there was attached an inhibition against the application of the public moneys to any of the purposes of the canal. The constitutional intent was and is, the court says, that the canal shall be self-supporting and that the peo-

ple of the state shall not be taxed to aid it in any way.

After reviewing at some length the debates of members of the constitutional convention, as aiding to a correct determination of the intent of the framers of the instrument, the court says:

Though it does not aid to the determination of the question of power of the Legislature to make the appropriation in question it is not inappropriaate to remark that the fears entertained by members of the constitutional convention that more modern and more speedy means of transporting passengers and commodities would soon supplant the canal and divert traffic from it and the canal would become practically of no use as a waterway or highway of traffic and commerce and would cease to produce an income sufficient to pay the expenses connected with its management and would, unless restrained by the constitution, become a regular applicant at the door of the state treasury for appropriation of money of the taxpayers of the state, have been verified.

In 1876 the tolls received for the use of the canal aggregated $113,293, but since that year there has been a marked and substantially gradual decrease in such receipts. In 1900, so little demand was there for the canal as a highway or waterway for the transportation of person or property that but $13,86; was paid as tolls. In 1901 the use of the canal for purpose of trade or commerce was so little availed of that but $8,120 was collected from tolls. In addition to all receipts, of every character, during these years heavy appropriations from the treasury of the state, amounting to something more than $500,000, have been asked to meet the deficiences arising from the management and operation of the canal. The canal has practically fallen into disuse for any of the purposes of transportation of either persons or property and has been perverted to mere commercial purposes of supplying water power to those along its banks and selling privileges to cut ice from its pools. It is no longer a higghway of commerce.

SEWAGE AND GARBAGE

Sewer Purification at East Haven, Ind.—Stream Pollution in Minnesota—New York Sewer and Water Commission—Practice in Removing Refuse—Garbage Collection and Disposal—Evclusive Garbage Contract Void.

The Sewage Purification Plant at the Eastern Hospital for the Insane.*

By Prof. R. L. Sackett, C. E.

The Eastern Indiana Hospital for the Insane has at present a population of about 800 and uses 100 gallons of water per individual per twenty-four hours by tank measurement. The buildings are situated about twenty-five feet above and 1,500 feet distant from Cedar Creek, into which the sewage was formerly discharged. The dry weather flow was only about 100,000 to 200,000 gallons per day and the dilution was wholly insufficient. The color was milky and fungus growth formed on the stones and bottom. The effect could be traced visually about two miles, where the volume was doubled by another stream.

Besides the usual culinary and human waste the sewage consists of a very large amount of laundry and bath water, roof water, a little surface and no ground water.

The use of disinfectants and the clothing which the inmates destroy and stuff in closets are disturbing factors requiring special attention in the design

The old main sewer of 18-inch cement tile was tapped near the buildings. In the manhole an emergency overflow was constructed so that an extraordinary storm could not choke the intercepting sewer. The latter consisted of a 10-inch line of vitrified pipe 1,100 ft. long, and 435 ft. of 10-inch iron water pipe, laid in an inverted siphon, in order to pass under a road and a railway.

The pipe line ends in a goose neck, discharging into a grit chamber 5 by 8 feet in plan. From it the sewage is led by three openings into the septic tank, which is 48

*From a paper before the Indiana Engineering Society.

feet long, 16 feet wide and may be operated under a head from 6 to 8 feet.

Various valves are provided by which the chambers may be cleaned and the sludge discharged on the surface of the ground for irrigation purposes. The structure, excepting the slate roof, is of concrete.

An 8-foot weir leads from the tank to the dosing chamber holding from 4,000 to 6,000 gallons, depending upon the depth.

This quantity is discharged automatically, at regular intervals of about thirty minutes, when the dose is 4,000 gallons.

The apparatus, manufactured by Mr. Shields of Chicago, operates four 12-inch valves leading to sewer pipe lines which conduct the sewage to the four filter beds. These valves are mechanically operated in turn by compressed air, the air being confined in a dome under water pressure.

The foundation and walls are of Portland cement concrete in the proportions of 1 of cement to 7 of an excellent quality of bank sand and gravel.

The floor is 6 inches thick and the side walls taper from 18 inches to 12 inches in a hight of 9 feet, the total hight being 10 feet. The gables are carried out in brick.

In order to render the walls water proof a coat of 1 to 1 cement mortar was troweled over the interior surface and the exterior wall surface which was exposed to water pressure. Over this a wash coat of neat cement was brushed on for finish. There is no seepage.

The reinforcement consisted of the use of liberal quantities of wire rope three-fourths of an inch in diameter laid in the inner third of the wall at all corners and into all cross walls.

The structure, which is 67 feet long, 20 feet wide and 10 feet high, has no expansion joints and has developed no cracks except one on each side caused by the soil under one end of the structure being soaked with sewage and settling slightly. This settling reached its limit very soon and the filled joint has given no trouble.

From the sewer lines, the effluent passes to the four filter beds, each of which is 100 feet square. To each bed there are three cypress troughs with side openings which distribute the sewage over the bed.

SEWAGE DISPOSAL PLANT.
Eastern Indiana Hospital for Insane.

The sewage as it goes on the beds shows only a slight milkiness in color, and the the solids are not visible to the naked eye.

The ground was graded to proper form and a grillage of farm tile was laid, leading to a 12-inch trunk, which discharges into Clear Creek about 150 feet distant.

On the tile a 6-inch layer of coarse gravel was placed, obtained by screening a portion of the top material. Three feet of bank gravel, practically unscreened, but very uniform in quality, and only 600 feet distant, completed the filters.

A concrete wall surrounds the whole and gravel walks divide the area into four equal beds.

As the tank effluent passes slowly, drop by drop, through the sand it is brought into intimate contact with the air, which has been drawn into the pores of the beds. Here oxygen is absorbed to complete the process of oxidation; reduc-

ing to nitrites and nitrates. The process is biological, not chemical, and the material of the filter is not important so long as it is insoluble and maintains a porous condition. More than one micro-organism has the power to take oxygen from the air and combine it with the ammoniacal fluid from the tank, thus producing water and nitrates.

If the process were perfect only pure water and harmless gases would be left. To maintain the efficiency, the supply of air to the filter must be about three times the quantity of nitrogen. Tests have shown that a quantity of air equal to from five to nine times the volume of sewage was flowing through the pores of the sand. Tests of the air coming from filter drains show that the oxygen is reduced, while carbon dioxide and nitrogen are increased, showing conclusively that the predicted action has taken place. (Bacterial Purification of Sewage by Barwise, page 38.)

The plant was put in operation Dec. 4 last and the effluent was soon very satisfactory to the eye.

When 5 degrees below zero, Fahrenheit, the temperature of the sewage thawed the frozen ground slowly, and at no time was the operation interfered with by freezing, even when the temperature was 20 degrees below zero.

As scientific data are lacking, it is proposed to make tests of three months' duration on various periods of septic action and the effect of large and small doses on the filters.

Analyses will be made of the sewage, effluent and filtrate, together with temperature, chemical, microscopic and biological analyses. In this manner the most efficient conditions under which to run this plant will be determined. It is only by providing for a change in the septic period and by experiment that the highest efficiency can be obtained, as the tank is so sensitive to local conditions that no rule of thumb will give the best results.

Extravagant claims have been made for the new processes of sewage purification, and they have not always been realized. Bacteriological processes require the very greatest care in weighing local and peculiar conditions and in adapting the requisite means to the end.

EFFECT OF EAST HAVEN FILTER ON SEWAGE.

Results in parts per 100,000.

	Sewage.	Effluent.
Free and Saline Ammonia ..	2.34	1.75
Albuminoid Ammonia	0.64	0.10
Total Solids .....58.		39.
Residue on Ignition .....23.		39.
Organic Solids ... .35.		18.
Oxygen Consumed in 15 min.	1.	0.2
Oxygen Consumed in 4 hours	1.88	0.3

Stream Pollution Prohibited in Minnesota.

The Minnesota State Board of Health has declared the discharge of sewage by any village, city or other municipality by means of artificial drains or a sewerage system into any well, pond, lake, stream or river in Minnesota to be a public nuisance, and it will be prohibited unless such sewage is first passed through a septic tank or filter bed. A year is allowed for the installation of septic tanks or filter beds. The general enforcement of this resolution would mean immense expenditures to the larger cities in the state, particularly St. Paul and Minneapolis. The sewage and surface drainage of both these cities are carried through the same pipes to the river. If the installation of filter beds is required it will mean the construction of entire new sewerage systems. The resolution applies to rivers within the state, and at St. Paul and Minneapolis the Mississippi River is such a river, but at Winona it it a boundary line between two states, and it is believed that the resolution would not be applicable to that city.

A Proposed New York State Board of Water and Sewer Commissioners.

A bill has been introduced in the New York Legislature providing for the placing of the water supply and sewer systems of the various cities and towns of that state under the control of a state board, similar in makeup and powers to the state railroad commission. The purpose of the bill is to create "The State Board of Water and Sewer Commissioners, to consist of three competent persons, who shall be appointed by the Governor by and with the consent of the Senate for a term of five years. One shall be a competent civil and hydraulic engineer and one a competent sanitary engineer and bacterioligist."

The salary of each commissioner is to be $8,000 and the board is to have a secretary at $3,500 and a marshal at $1,500, together with clerical force, inspectors, bacteriologists and chemists at a gross expense for salaries not to exceed $15,000 a year. The bill appropriates $75,000 to carout the provisions of the act.

To this commission is given almost absolute control over improvements, filtration systems, new sewerage arrangements, sewage disposal plants, extensions of existing systems and plants and in general abatement of everything which may be regarded by the commission as inimical to public health so far as it concerns sewerage or water supply.

How Many Cities Remove Ashes and Refuse and the Cost.

Street Commissioner Pierson of Wilmington, Del., has been collecting comparative data of methods and cost of collecting ashes and rubbish in other cities. He recently sent letters to some of the principal cities and has received replies from twenty-eight of them giving the desired information. Data compiled from these letters, which included the practice followed in Wilmington, are as follows:

Wilmington—Population, 76,508. The city removes rubbish incidental to housekeeping, paper if tied up in bundles, but does not remove factory ashes. The carts are owned by the city and horses are hired by the day. The collections are made from the curb, once a week. The cost is $8,209.46 per annum, based on last year's cost, or 10 cents per capita.

Baltimore, Md.—Population, 508,957. The city removes the ashes and all household waste, including paper from dwelling and apartment houses. This does not include the ashes from factories, bakeries and steam boilers. The work is done by contract, and the collections are made from both yard and streets, three times a week. The cost for removing ashes and garbage is $195,800 per annum, or 22 cents per capita.

Boston, Mass.—Population, 560,892. The city removes all rubbish incidental to housekeeping and newspapers if tied in bundles; 10 cents per barrel extra being charged for removing ashes from factories, etc. The city owns most of the teams, but the work in the suburbs is done by contract. Collections are made only from yards; twice a week in winter and once a week in summer. The cost is $384,018.45 per annum, a per capita of 68 cents.

Buffalo, N. Y.—Population, 352,219. The city removes general household refuse and newspapers if the latter are kept separate. It does not remove factory ashes. The work is done by contract and is gathered from yards, if necessary. Collections are made twice a week from May to November and once a week from November until May. Collections are made in business sections daily. The cost is $81,705.34, or 21 cents per capita.

Cincinnati, O.—Population, 325,902. The city removes the ashes from dwellings, but does not remove factory ashes. The work is done by contract and the ashes are removed from streets and alleys two and three times per week at a cost of $103,000.

Columbus, O.—Population, 125,560. The city does not remove ashes, rubbish or paper.

Cleveland, O.—Population, 381,768. The city does not remove ashes or rubbish.

Chicago, Ill.—Population, 1,698,595. The ashes and household rubbish, outside of garbage, are removed by the city. Only such papers as are thrown out with other rubbish are taken. Factory ashes are removed at owner's expense. The city hires teams by the day, and collects from both yards and streets, weekly, semi-weekly and tri-weekly; business sections, daily. For ashes and garbage the cost is $645,000, which is 32 cents per capita.

Detroit, Mich.—Population, 285,704. The city collects all rubbish incidental to housekeeping, including newspapers. It does not remove factory ashes. The city hires teams by the day, and gathers from alleys or lanes which run between the streets. The collections are made in the residence sections twice yearly, and in the business and rooming-house sections as often as they beomce a nuisance. The expense is paid out of the street cleaning fund and is not made a separate acocunt.

Elizabeth, N. J.—Population, 52,130. The collection af ashes is made by the city by contract. The ashes and rubbish are taken from the sidewalks weekly at a cost of $7,100.

Hartford, Conn.—Population, 79,850. The city removes the ashes and rubbish, which includes general household rubbish and paper tied in bundles; does not remove factory ashes. The work is done by contract, and the collections are made from the sidewalks, onec a week in residenec sections and twice a week in business sections. For ashes and garbage the annual cost is $20,547.

Indianapolis, Ind.—Population, 169,164. The city does not remove the ashes.

Newark, N. J.—Population, 246,070. The city removes the ashes and rubbish, including paper. It does not remove factory ashes. The work is done by contract, the collections being made from sidewalks. The cost for removing ashes and garbage is $79,164 per annum.

New York City, N. Y.—Population, 3,437,202. The city removes the ashes and rubbish. By hanging out special cards the city calls for household refuse and removes same in special wagons. It removes bundles of paper and sells it, but does not remove factory ashes. The work is done by contract.

Philadelphia, Pa.—Population, 1,293,697. The city removes ashes and household waste; also newspapers. The work is done by contract, the collections are made from the streets weekly, and costs, including the cleaning of the streets, $693,850.

Paterson, N. J.—Population, 105,171. The city removes household rubbish and a limited amount of waste paper; but does not remove factory ashes. The work is done by contract; collections are made from the curb weekly. The collection of ashes and garbage costs $30,000.

Richmond, Va.—Population, 85,000. The city removes rubbish of every description, including waste paper; but only a few newspapers are taken. The work is done by contract and collections are made from two to three times weekly from streets and alleys. Street cleaning, ashes and garbage cost $69,056, which is 69 cents per capita.

Rochester, N. Y.—Population, 162,435. The city removes all rubbish, all kinds of waste paper and factory ashes. Private teams are hired, paid per load for four yards, according to distance. The ashes are collected from yards, daily, semi-weekly and weekly. The cost is $80,000.

Syracuse, N. Y.—Population, 108,374. The city removes all household rubbish, newspapers, in small bundles, but does not remove factory ashes. The city hires teams and collections are made from the streets every day in the centre of the city and every week in outlying districts. The cost is $20,000, which is 17 cents per capita.

Trenton, N. J.—Population, 73,307. The city removes houshold rubbish and waste paper, but does not remove factory ashes. The work is done by contract and collections are made from streets and alleys every other day. The cost is $20,000.

Washington, D. C.—Population 278,718. The district removes miscellaneous refuse and waste paper, but does not remove factory ashes. The work is done by contract. Rubbish is kept on premises until called for by contractor once a week. The cost is as follows. Ashes, $29,979; refuse, $8,000; total, $39,979, which is 14 cents per capita.

Albany, N. Y., 94,151 population; Columbus, O., 125,560; Cleveland, O., 381,768; Indianapolis, Ind., 169,164; New Haven, Conn., 108,027; Providence, R. I., 175,597; Reading, Pa., 78,961; St. Louis, Mo., 575,238; Toledo, O., 131,822; Scranton, Pa., 102,026; and Pittsburg, Pa., 321,606;, do not remove the ashes. In Pittsburg natural gas forms the greatest part of fuel, and, consequently, there is a scarcity of ashes there, so far as dwellings are concerned.

City Practices in Garbage Collection and Disposal.

The inquiries sent out recently by Dr. T. M. Koon, secretary of the special joint garbage committees of the Council and Board of Health at Grand Rapids, Mich., brought forth considerable interesting and valuable information on garbage collection from fifteen cities. In twelve cities the garbage is collected in wagons, two in barrels, one in boxes and none in cans. In nine of the cities the garbage is collected by contract, and the city collects it in the other six cities. Householders own their own cans in twelve cities, and no statement is made regarding this in the other three. Disposal of garbage by cremation is followed by five cities, including Minneapolis, Syracuse, N. Y.; Columbus, O., and Milwaukee. Reduction is used in Utica, N. Y., population 56,383; Buffalo, N. Y., 352,387; Detroit, Mich., 285,704.

In Worcester, Mass., whose population is 125,000, the garbage is collected from the entire city in wagons by contract, and is hauled to the poor farm, where it is fed to the hogs owned by the city. The following statement for 1903 is given:

Cost of collection	$18,140 57
Receipts from pork	11,941 55
Net expense	6,199 02

Other cities with populations given, report the following receipts in 1901 from the sale of garbage:

Lowell	94,969	$2,833 40
Cambridge	91,886	8,016 17
Lynn	68,513	3,788 82
Springfield	62,059	1,333 53

Toledo, 131,822, and Syracuse, 108,374, collect the garbage by the city, from 20,000 houses in each city at a cost of $14,000 and $20,000 respectively.

Cincinnati's Exclusive Garbage Contract Ordinance Invalid.

A decision was rendered by the Circuit Court at Cincinnati, Jan. 19, declaring invalid the ordinance regarding the hauling of garbage through the streets. The decision was rendered in the habeas corpus proceedings of David Bauer against James Casey, inspector of police, and others. The plaintiff was arrested on the charge of hauling garbage through the streets, and was fined $50 and costs in Police Court. He attacked the validity of the ordinance and the lower courts split the ordinance, holding that, while Bauer had no right to haul garbage through the streets under the ordinance, he might haul similar substances of value to himself. Under the ordinance the desiccating company has the sole right to haul the city garbage. The plaintiff's attorneys fought the case through to the

Circuit Court, and there they won their contention that the lower court had no right or authority to seperate the ordinance. The Circuit Court took this view of the case and held that the assumption of the lower court that the Board of Legislation had omitted unintentionally a vital part of the ordinance, was untenable. The ordinance is, therefore, declared invalid.

CEMENT AND CONCRETE

Concrete Foundation and Cement Filler for Brick Pavement—Concrete Masonry—Concrete—Cinder Concrete in Baltimore Fire.

Concrete Foundation and Cement Filler for Brick Pavement.*

By. O. L. Gearhart, City Engineer, Champaign, Ill.

In this paper it is proposed to discuss the economic relations between concrete foundations of different compositions and cement filler.

The Concrete.—About a year ago the writer made a series of experiments to determine the variation in the strength and cost of concrete d ue to a variation in the kind of cement and in the proportions of the ingredients. The former practice was to use a natural cement concrete for the pavement foundation, but on one occasion the Portland cement concrete, consisting of one part Portland cement and nine parts fine gravel, was used with excellent result. This led the writer to give the matter of Portland cement concrete further study.

The numbers of specimens made were about as follows: Twenty-five 8-inch cubes, twenty-five 6-inch cubes and twenty-five 6x6x21½-inch beams. Eleven different proportions with Portland cement and one proportion with natural cement were used. One each of the two cubes and one beam were tested at the two different ages, viz.: 30 days and 90 days. Owing to other matters that were occupying the writer's attention at that time the age for breaking specimens intended for the 90-day tests varies somewhat, but the difference is not enough to materially change the results. The different specimens were made by the writer at the Champaign City Laboratory, and through the kindness of Professor A. N. Talbot were tested on the machines belonging to the Department of Applied Mechanics at the University of Illinois. Only details essential to the understanding of the results will be mentioned here.

Materials.—The materials used were Atlas Portland cement, Clark's Utica cement, gravel from a pit northwest of Urbana, Ill., sand from a bank in the same locality and broken stone from a quarry at Kankakee, Ill. The sand was a fair quality of building sand containing some clay and having about 35 per cent. of voids. Of the gravel 23 per cent. was retained on a No. 4 sieve, 53 per cent. on a No. 10 sieve, 71 per cent. on a No. 20 sieve and 29 per cent. passed a No. 20 sieve. This material contained 21 per cent. voids. It will be seen that the gravel contained but little coarse material. The broken stone was a good quality of stratified limestone, crushed so that all of the particles would pass a screen of two-inch mesh and be retained on a screen of one-half-inch mesh. This material contained 4 per cent. voids. The stone is bought by weight, and as the freight is quite an item it is found to be cheaper in Champaign to buy screened stone and fill the voids with a larger amount of gravel than would otherwise be necessary.

The cement was taken from bags shipped to this city for the retail market and was not a special cement for testing purposes. It will be seen that the Utica cement is a very high grade of natural cement and that the Atlas cement is a good quality of Portland. The fineness of the cement is as follows:

	Utica.	Atlas.
Per cent. passing sieve No. 50	97.4	99.6
Per cent. passing sieve No. 100	80.5	92.5

The activity of the cement is as follows:

	Utica.	Atlas.
Time from mixing to initial set	:32	1.56
Time from mixing to final set	3:20	5:16

*A paper before the Illinois Society of Engineers and Surveyors.

The tensile strength of the cement in pounds per square inch is as follows:

Cement.	Per Cent. of Water.	Age.		
		24 hrs.	7 ds.	30 ds.
Utica.....	31	80	181	230
Atlas.....	17	265	710	.....

Mixing and Testing.—The cement and gravel were thoroughly mixed dry, then wetted and mixed into a stiff mortar, after which the dampened stone was added and the whole was turned several times. The mixture was then tamped into the molds by means of an eleven-pound tamper, having a face area of nine square inches. About two or three inches of loose material was placed in the molds at a time and tamped. During the operation a square-ended trowel was worked up and down between the concrete and form, thus bringing the mortar to the sides and corners of the specimen and making it homogenous throughout. In every case only enough water was used to cause a film of water to come to the surface after considerable tamping. The cubes were left in the molds for twenty-four hours with a damp cloth over them, after which time the molds were carefully removed and the specimens were stored under cloths, which were dampened from time to time until the cubes were tested. The concrete beams were made and stored in the same manner as the cubes.

In crushing the cubes and breaking the beams, the direction of the force applied was perpendicular to the tamped surface. Immediately before crushing the cubes the two faces to which the force was applied were plastered with a thin coat of plaster of Paris and a self-adjusting plate was used to distribute the pressure over the entire surface of the cube.

Costs.—In arriving at the cost of the concrete, gravel and sand were taken at 90 cents per cubic yard, broken stone at $1.40, Utica cement at 65 cents per barrel, Portland cement at $2, and labor for measuring, mixing, placing, grading and tamping a six-inch layer of concrete was taken at 6 cents per square yard.

Results.—Table I shows the strength of the cubes and beams and also gives the yield of rammed concrete in terms of the sum of the volumes of the gravel and broken stone. This table also shows the cost per square yard of a six-inch layer of concrete of the different compositions.

Conclusions.—From the tests given in tabe I, it is believed that the following conclusions may be drawn:

TABLE I.

STRENGTH AND COST OF CONCRETE OF DIFFERENT COMPOSITIONS.

No.	Proportions.				Yield in terms of volumes of gravel and broken stone.	Age, days.	Load on cubes, lbs. per sq. in.		Average crushing strength, lbs. per sq. in.	6″x6″x18″ beams.		Cost per sq. yd. for depth of 6″, cents.
	Cement.	Sand.	Gravel.	Broken stone.			8″	6″		Load at center, lbs.	Modulus of rupture, lbs. per sq. in.	
NATURAL CEMENT.												
1	1	.....	3	3	.....	30	610	540	575	1280	160	.....
2	1	.....	3	3	77 %	90	870	470	670	1270	159	49
PORTLAND CEMENT.												
3	1	.....	5	.....	80.4%	30	1750	1565	1657	2700	338	77.5
4	1	.....	5	.....	.....	90	1770	1990	1880	3060	382	.....
5	1	.....	4	4	74 %	30	1500	1365	1432	2440	305	74.6
6	1	.....	4	4	.....	90	2210	1780	1995	5360	670	.....
7	1	.....	6	4	70.7%	30	1180	1170	1175	1800	225	68.6
8	1	.....	6	4	.....	90	1260	1430	1345	1620	203	.....
9	1	.....	5	5	74.4%	30	2250	1545	1897	2800	350	66.1
10	1	.....	5	5	.....	90	1850	2050	1950	3280	410	.....
11	1	.....	8	4	72.8%	30	890	840	865	1650	206	57
12	1	.....	8	4	.....	105	883	1230	1056	2500	313	.....
13	1	.....	6	6	76 %	30	1290	895	1092	2550	319	64
14	1	.....	6	6	.....	90	1510	930	1220	3060	383	.....
15	1	.....	8	6	74 %	30	965	570	767	1750	219	56.8
16	1	.....	8	6	.....	115	1425	860	1142	1700	213	.....
17	1	.....	7	7	74 %	30	1240	1365	1302	2100	263	56.6
18	1	.....	7	7	.....	90	1190	1425	1307	2820	353	.....
19	1	.....	8	8	73 %	30	1010	990	1000	1600	200	51.4
20	1	.....	8	8	.....	103	1050	1030	1040	1930	241	.....
21	1	.....	10	10	71.5%	30	530	600	565	1010	126	50.3
22	1	.....	10	10	.....	118	585	.....	.....	1220	153	.....
23	1	.....	10	10	.....	102	.....	610	.....	.....	.....	.....
24	1	6	.....	6	.....	30	1230	*780	1230	1780	223	.....
25	1	6	.....	6	.....	107	1720	1535	1627	2410	301	.....
26	1	.....	8	16	†70 %	.....	.....	.....	.....	.....	.....	51

* Defective and omitted from average. † Assumed.

1. From numbers 2 and 20 in table I, we see that the cost of Portland cement concrete is about 4 per cent. more than natural cement concrete, while the former is 50 per cent. stronger.

2. By comparing numbers 2 with 23 and 24, it is seen that the strengths of concrete composed of 1 part natural cement, 3 parts gravel and 3 parts broken stone, and concrete composed of 1 part Portland cement, 10 parts gravel and 10 parts broken stone, are nearly equal.

3. By comparing experiment number 4 with number 10, it is seen that the addition of broken stone in amount equal to the gravel, without increasing the quantity of cement, materially increases the strength and decreases the cost of the concrete.

4. Numbers 12, 16 and 20 show that the increase of the broken stone from four parts to eight parts does not materially change the strength of the concrete, but reduces the cost.

Table II shows the result obtained by supporting the beams on knife edges 24 inches apart and applying the load at the center.

By comparing number 2 and number 20 in Table I with number 3 in Table II it will be seen that a brick beam four inches in depth is 50 per cent. stronger than a concrete beam consisting of one part natural cement, three parts gravel, and three parts broken stone, and is also a little stronger than a beam consisting of one part Portland cement, eight parts gravel, and eight parts broken stone. This fact suggests the idea whether it may not be economical to employ the cement as a filler between the brick rather than using it in the concrete foundation.

The cost of the cement and labor for a six-inch layer of concrete composed of

TABLE II.

MODULUS OF RUPTURE OF BRICK BEAMS WITH CEMENT FILLER.

No.	Filler. Cement.	Filler. Sand.	Name of Brick.	Age Days.	Dimensions of Beam in Inches. Depth.	Breadth.	Length.	Load at Center, Lbs.	Modulus of Rupture, Lbs. Per Sq. In.	Beam 6"x4", 18" Span, Load at Center, Lbs.	Cost of Filler Per Sq. Yd. Cents.
1	1	1	Clinton.	30	4	10½	24	1640	351	1248	8 to 12
2	1	1	"	30	4	10¾	24	2160	452	1607	"
3	1	1	"	90	4	10¾	24	2660	557	1981	"
4	1	1	Culver.	30	4	11	24	2570	526	1870	"
5	1	1	Poston.	122	4	11	24	2210	452	1607	"

5. By comparing numbers 18 with 26, it is seen that the increase of the broken stone from eight parts to sixteen parts does not materially change the cost of the concrete.

6. About half a mile of pavement having a very lean Portland concrete was laid during the past season under the writer's direction. It was found, much to the surprise of the writer, and also to the contractor, that not only the very lean concrete was more easily mixed, but it was more uniform than the very rich natural cement concrete, heretofore used.

In all respects the Portland cement concrete is superior to the natural cement concrete.

Brick Beams.—The writer made a number of brick beams by taking paving brick and cementing them together with a cement filler. The beams were three bricks long, three bricks wide and four inches deep. They were formed by laying the brick side by side as in the pavement, and the interstices were filled with grout consisting of one part Portland cement and one part sand.

one part Portland cement, eight parts gravel, and eight parts broken stone is about twenty-four cents per square yard more than that of a compacted layer of gravel or broken stone; and the cost of the cement filler is about six to ten cents per square yard more than sand filler. Therefore a brick pavement with cement filler on a foundation of broken stone or gravel without any cement in it is from 14 to 18 cents per square yard cheaper than brick pavement with a sand filler and with a concrete foundation; and further, the two forms of construction are of equal strength.

For a pavement on a street which has been cut up with trenches and where the filler adds very much to the strength and to the life of the improvement, the added expenditure for the filler is money well invested. In residence districts, where the traffic is not so heavy or constant, a brick pavement with cement filler and a gravel foundation may be constructed with advantage and the cost of

the improvement be considerably less than if a concrete foundation and sand filler be used.

As far as the writer knows, attention has not before been called to the strength produced by the cement filler, nor the fact that the brick thus filled makes the beam 50 per cent. stronger than the use of concrete foundation; and in view of what has been said concerning strength of the cement filler, to use it in pavement construction is clearly an economical advantage.

For several valuable suggestions, the write gratefully acknowledges his indebtedness to Prof. A. N. Talbott and Prof. I. O. Baker.

Concrete Masonry with Special Reference to the Use of Natural Bank Gravel.*

By George S. Pierson, M. Am. Soc. C. E., Kalamazoo, Mich.

The varied uses to which concrete is put demand different mixtures. In some cases, a concrete with but a small proportion of cement and which requires no surface finish will answer the purpose. In other cases strength is the important consideration, in others a smooth surface finish, and in others the power to resist abrasion; but whatever the use to which concrete is to be put, the desired results should be economically secured.

One of the principal items of cost in concrete masonry is the aggregate. Michigan has many natural deposits of gravel and sand from which excellent concrete may be made. Often such deposits are found nearby the work—sometimes in the very excavation which is made for the structure. These deposits often occur containing gravel and sand in proper proportions for use in concrete. Sometimes the natural mixture is in every way better and more economical for use in concrete than one required by the usual specifications of one, three and five, because in the process of deposition the material was well washed, and accumulated in a way that tended to make it compact and to contain a small proportion of voids. Often such deposits may be improved as aggregates and the voids considerably reduced, by adding a small proportion of sand if they are too coarse, or of coarse gravel if they are too fine, and considerable cement can thus be saved with no detriment to the quality of masonry.

The writer was engaged in the design

MECHANICAL ANALYSIS OF NATURAL BANK GRAVELS.

	No. 1. %		No. 2. %		No. 3. %		No. 4. %	
Screen.	Ret'd.	Diff.	Ret'd.	Diff.	Ret'd.	Diff.	Ret'd.	Diff.
1½ inch	8.0	8.0						
1 inch	21.7	13.7	4.9	4.9	10.0	10.0	9.0	9.0
¾ inch	31.7	10.0	9.5	4.6	14.0	4.0	15.4	6.4
½ inch	44.0	12.3	15.3	5.8	19.4	5.4	26.0	10.6
¼ inch	59.4	15.4	27.5	12.2	31.6	12.2	41.6	15.6
⅛ inch	68.8	9.4	38.1	10.6	44.0	12.4	59.0	17.4
1/10 inch	70.8	2.0	41.4	3.3	47.0	3.0	64.0	5.0
1/20 inch	79.6	8.8	61.8	20.4	66.8	19.8	89.4	25.4
1/50 inch	96.4	16.8	95.5	33.7	96.2	29.4	97.6	8.2
1/100 inch	99.0	2.6	97.6	2.1	99.2	3.0	99.0	1.4
		1.0		2.4		.8		1.0
		100.%		100.%		100.%		100.%
Voids, loose	25.%		28.5%		25.8%		23.5%	
Weight per cu. ft. loose	124 lbs.		113.		120.		133.	
Specific gravity of particles	2.64		2.53		2.60		2.77	

*From a paper before the Michigan Engineering Society.

and construction of a concrete waste weir last season, and as the price of cement was high at the time and the material for the aggregate must be brought from a distance, it seemed worth while to make a more than usually careful examination of material which could be secured for an aggregate. Samples were taken from several deposits and analyzed with the result shown below.

It is difficult to secure a fair sample from the face of a pit where the gravel is sloughing and running down the face, as the coarser particles are separated and carried farther down the slope. The material also varies in composition as it lies in most pits and must vary somewhat as it is delivered for use on the work. This objection is not peculiar to natural bank gravel, however. The same objection may be urged against the crushed stone often used as an ingredient of the aggregate, and against the sand used with it. Although it is improbable that the analyses represent precisely the conditions of the aggregate as it is received on the work, a comparison of the analyses with each other and with the samples to which they refer appears to be of considerable assistance in deciding the relative value of material from different deposits, and in detecting variations in the quality of material as it is delivered.

Sample No. 1 contains excellent material, but the sample indicates that the addition of quite a proportion of coarse sand would result in a stronger and more impervious concrete, a smoother finish and saving in cement.

Sample No. 2 is poorest of all. It contains too small a proportion of large particles, too great a proportion of fine sand, and some clay. The voids in it are greater than in any of the others and the weight per cubic foot and also the specific gravity of the particles, less than in any of the other samples.

Sample No. 3 contains too small a proportion of coarse particles for economy.

Sample No. 4 contains a larger proportion of particles from one-eighth-inch to one-half-inch than any of the other samples. Probably a larger proportion of sizes three-fourths inch to one inch would be desirable in massive work and require less cement, though probably not as smooth a finish could be obtained. The voids in this sample were less than in any of the others examined, the weight per cubic foot greatest, and the specific gravity of the particles highest. This material was fairly accessible. Tests of the material were made frequently during construction and it was found that the addition of a small proportion of a rather fine, gray sand, which was found in the excavation, slightly reduced the voids and made a smoother finish next the forms.

The voids in all the samples were measured with the material dry and loose. As placed in the work the voids would, of course, be much less.

A convenient rule for determining approximately the voids in gravels, one which can be conveniently applied in the field, is the following: I have found that the natural gravels in this vicinity have an average specific gravity of about 2.65. This corresponds to a weight per cubic foot, if there were no voids, of 166 pounds. If a known measure of gravel be weighed and its actual weight per cubic foot ascertained, then the voids in the condition in which it was weighed will be: Per cent. of voids equals 166, minus weight per cubic foot, divided by 166.

Gravels differ considerably in the character of the particles. Some are made up of well-rounded and smooth particles, and in some the particles are more angular and the surface rougher, which is advantageous.

Under a compound microscope with one-inch objective the sand and fine gravel in sample No. 4 seems sharper than in any other of the samples, with No. 1, No. 3 and No. 2 following in the order named. The gravel in sample No. 3 seems roughened by fine sand particles which adhere to the surface, and this would probably give a better adhesion to the matrix.

Probably natural bank gravels as they are taken from the pit or mixed with small proportions of fine or coarse material as a corrective, can be used in concrete to better advantage than they usually are. This material can be selected or mixed so as to adapt the concrete to a wide range of uses, from rough and massive work to work which is light and finished in mould which require sharp and perfect details. The labor which can be judiciously spent in selecting or balancing the aggregate will be determined by the current price of cement and the use to which the concrete is put.

Concrete.*

By S. B. Newberry, Sandusky, O.

Concrete is a compact mass composed of sand and broken stone or gravel, united by cement.

Hydraulic cement concrete has been known since an early period of history. It is, however, only since Portland cement has been cheaply produced and greatly

*From a paper before the Indiana Engineering Society.

improved in quality and uniformity that concrete construction has attracted the attention of engineers. At the present day Portland cement concrete is being adopted with astonishing rapidity in all kinds of constructions in place of stone, brick, wood and iron. Portland cement is the essence of rock in portable form. When judiciously used it will convert many times its volume of loose sand, gravel and waste stone into a solid brick or monolith, of any desired shape, equal in strength and durability to the best rock from the quarry. It is not surprising that a material which will do this should be in great demand.

Materials. — Sand should be clean and sharp. The sands which give the highest tests with cement are those showing rounded grains with a dull surface. A mixed size of grain, from fine to coarse, is better than a grain of uniform size. The presence of a small amount of clay, up to 4 or 5 per cent., does not harm if concrete be thoroughly mixed and sufficiently wet.

Gravel and broken stone should be hard and sharp, and as free as possible from soft particles. The harder the stone the better the concrete will be; trap rock or crushed flint or quartz are superior to soft limestone or sandstone. As in the case of sand, a mixed material, fine to coarse, is preferable, and screening is generally injurious. It was formerly supposed that the presence of fine dust in the materials was objectionable. This is not the case if the mixing be thorough. It is quite possible that with imperfect mixing a film of clay or stone-dust might coat the stone or gravel and prevent adhesion of the cement. If the mixing be thorough, however, these fine materials will help to fill the voids and increase the strength. The most competent engineers now use crushed stone without screening, containing all the dust from the crusher.

Many engineers consider broken stone superior to gravel for concrete. With this view the writer does not agree. Good quartz gravel is harder than any broken stone except trap or quartzite, and owing to its rounded form contains much less voids than stone. There is no ground for believing that rounded stone or rounded sand gives less strength with cement than material composed of angular fragments. Certain natural sands, with nearly spherical grains, show much higher tests with cement than angular crushed quartz. Comparative tests of crushed stone and gravel concrete are not available, but the many examples of faultless work with cement, sand and gravel show that where good, coarse gravel is abundant there is no need of going to a distance for a supply of costly crushed stone.

Proportions. — The chief object in compounding concrete is to produce a compact mass, as free as possible from pores or open spaces; in short to imitate solid rock as closely as possible. To produce a compact mass from fragmentary materials the voids must be filled. Imagine a box holding one cubic foot. If this were filled with spheres of uniform size, the voids or open spaces would be 25.95 per cent. of the total volume. With spheres of various sizes, as, for example, from large marbles down to small shot, the voids would be much less, and it would theoretically be possible, by the use of spheres of graded sizes, from the largest down to dust of infinite fineness, to fill the box completely, so that there should be no voids whatever. In practice it is well known that the use of materials of varying fineness gives the best concrete, since the voids are much less than in materials composed of pieces of uniform size. Hence the common practice of making concrete with cement, sand and broken stone, instead of stone only. The sand fills the voids of the stone, the cement fills the voids of the sand, and if the proportions are correct a practically solid mass results. As an example of this, the writer found that briquettes of cement with three parts sand and four parts gravel showed higher tensile strength at twenty-eight days than those made with three parts sand only.

The determination of the percentage of voids in the gravel or broken stone to be used is of the greatest importance. This determination is most easily made by the use of a metal box of exactly 1 cubic foot (or a known part of a cubic foot) capacity. This is weighed, filled with the material, well shaken down, and again weighed. Now, quartz sand or limestone (carbonate of lime) has a specific gravity of 2.65. One cubic foot of solid quartz or limestone, free from voids or pores, would therefore weigh 2.65 times as much as a cubic foot of water (62.4 lbs.), or 165.4 lbs. The difference between the weight actually found and 165.4 represents the amount of voids. For example, a cubic foot of sand was found to weigh 112 lbs., or 53.4 lbs. less than a solid block would weigh. The percentage of voids was, therefore, 53.4 multiplied by 100 divided by 165.4 equal to 32.2 per cent.

The following table gives the percentages of voids in a number of materials as determined by the writer:

	Per cent.
Sandusky Bay sand, not screened	32.2
Sandusky Bay sand, through 20 mesh	38.5
Sandusky Bay, 20-30 mesh	40.7
Gravel, ¼ to ⅛ inch	42.4
Gravel, ¼ to 1-20 inch	35.9
Marblehead broken stone, about egg size	47.0

Comparison of the three different grades of Sandusky Bay sand shows how greatly the percentage of voids varies with the proportion of fine and coarse grains present. The first is the natural sand, not screened, as pumped up by the sand-sucker from the bottom of the bay, and contains a large amount of fine gravel. The second is the same, passed through a 20-mesh screen to remove the coarse particles. It will be seen that this operation increases the proportion of voids from 32 to 38 per cent. The third is the same sand, passing a 20-mesh and retained on a 30-mesh screen, thus brought to the fineness of the "standard sand" used in cement testing. This shows 40.7 per cent. of voids, owing to the uniform size of the grains. The same relation is seen in the two grades of gravel given in the table, that containing finer grains showing much the lower percentage of voids. These figures illustrate the imprudence of screening any of the materials used in making concrete.

As an aid in determining the voids in concrete materials, the writer has prepared the following table, in which the percentages of voids corresponding to various weights per cubic foot may be seen at a glance. The figures given in this table are calculated on the assumption that the specific gravity of sand, gravel and stone is 2.65.

Table showing weight per cubic foot and per cent. voids in sand, gravel and broken stone.

Wt. per cu. ft.	Per cent. voids.	Wt. per cu. ft.	Per cent. voids.	Wt. per cu. ft.	Per cent. voids.
165.4	0.00	135	18.38	105	36.52
164	.85	134	18.98	104	37.12
163	1.45	133	19.58	103	37.73
162	2.06	132	20.19	102	38.33
161	2.66	131	20.80	101	38.94
160	3.26	130	21.40	100	39.54
159	3.87	129	22.01	99	40.15
158	4.47	128	22.61	98	40.75
157	5.08	127	23.22	97	41.35
156	5.68	126	23.82	96	41.96
155	6.29	125	24.43	95	42.56
154	6.89	124	25.03	94	43.17
153	7.50	123	25.63	93	43.77
152	8.10	122	26.24	92	44.38
151	8.71	121	26.84	91	44.98
150	9.31	120	27.45	90	45.59
149	9.92	119	28.05	89	46.19
148	10.52	118	28.66	88	46.80
147	11.13	117	29.26	87	47.40
146	11.73	116	29.87	86	48.00
145	12.33	115	30.47	85	48.61
144	12.94	114	31.08	84	49.21
143	13.54	113	31.68	83	49.82
142	14.15	112	32.28	82	50.42
141	14.75	111	32.89	81	51.03
140	15.36	110	33.49	80	51.63
139	15.96	109	34.10	79	52.24
138	16.57	108	34.70	78	52.84
137	17.17	107	35.31	77	53.45
136	17.78	106	35.91	76	54.05

Having determined the voids in the sand and gravel and stone, let us next inquire how we shall calculate the proportions in which the materials are to be used. At first glance it might be supposed that the larger the proportion of cement a concrete contains, the stronger it will be. This is by no means necessarily the case, as the following table, taken from a paper by Dykerhoff, clearly shows. This table gives the crushing strength of various concretes, determined by tests of 2½-inch cubes after 1 day in air and 27 days in water.

Proportions by Measure.			Strength under compression. Pounds per sq. inch.
Portland Cement.	Sand.	Gravel.	
1	2	.....	2,125
1	2	3	2,747
1	2	5	2,387
1	.....	5	978
1	3	.....	1,383
1	3	5	1,682
1	3	6½	1,515
1	4	.....	1,053
1	4	5	1,273
1	4	8½	1,204

These figures prove that mixtures of cement and sand are strengthened rather than weakened, by the addition of a suitable quantity of gravel. It will be noticed that the mixture—cement 1, sand 2, gravel 5—is actually stronger than cement 1, sand 2, without gravel. The same is shown in the mixtures 1 to 3 and 1 to 4. Again, the last mixture, 1:4: 8½, containing only 7.4 per cent. cement is stronger than the mixture 1:4, containing 20 per cent. cement. One barrel of cement, judiciously mixed with sand and gravel, is therefore as good as 3 barrels used with sand only.

As to the proportion in which the materials are to be mixed to give the best result, Mr. Wm. B. Fuller (Proc. Am. Soc. Civil Engrs. Dec. 1899) points out that "there is one proportion, and only one, in which a given sand and stone can be mixed and give the minimum of voids;

this is the proportion in which they should always be mixed, whether a rich or poor concrete be desired."

Mr. Fuller's rule is:

"Mix the sand and stone (or gravel) in a definite fixed quantity for the material in use, and add cement as economy dictates, possibly up to 10 per cent. in excess of the voids in the combined material."

To determine the practical value of this rule, the writer made experiments with the following materials:

	Wt. Per Cu. ft.	Per Ct. Voids.
Gravel, about 1 in. in size	101.2 lbs.	38.7
Sand, 20 to 40 mesh	105.8 "	35.9
Cement, Medusa	114.5 "	....

The weights of these materials were determined by filling a metal cylinder of a measured fraction of a cubic foot capacity.

Since the gravel contains 38.7 per cent. voids, we shall require 38.7 per cent of a cubic foot of sand to fill these voids. If the materials could be perfectly mixed, the sand would exactly fill the voids in the gravel, and the mixture would weigh 142.1 lbs. per cubic foot, and would contain 38.7 times 35.9 divided by 100, or 13.9 per cent. of voids.

Mixtures in this proportion, and with greater quantity of sand, were made and the volume-weight determined with following results:

	Wt. Per Cu. ft.	Per Ct. Voids.
Gravel, 38.7 per cent. sand	133.5	19.2
Gravel, 50 per cent. sand	133.7	19.1
Gravel, 60 per cent. sand	131.2	20.5

It will be noted that increase of the sand from the calculated volume, 38.7 per cent. to 50 per cent., makes practically no difference in the density, while further increase to 60 per cent. increases the voids and injures the mixture.

Further tests of the same materials were made, with the addition of the volume of cement necessary to fill the calculated voids in the mixed sand and gravel. The results were:

		Wt. per cu. ft.	% Voids
Gravel + 30% sand	+ 13.9% cement	137.9	16.5
" + 38.7% "	+ 13.9%	142.5	13.7
" + 50% "	+ 13.9%	140.7	14.8

These figures show strikingly that the calculated proportion of sand gives greater density than a greater or less amount, and prove the value of determining the voids in the stone or gravel and adjusting the proportions on this basis.

It will be observed that in the mixtures of sand and gravel the maximum weight obtained was 133.7 pounds per cubic foot, and the minimum voids 19.1 per cent. This will vary considerably with different materials, but those materials are certainly best which when mixed in the most favorable proportions give the greatest weight per cubic foot. Any good gravel and sand, rightly proportioned, will show at least 130 pounds; the best result the writer has ever obtained was 139 pounds, corresponding to 13 per cent. voids. Broken limestone and sand give less density, rarely more than 125 pounds per foot. A few trials with available materials will enable an engineer to specify a minimum weight per cubic foot for materials to be used in a given piece of work.

Proportion of Cement.—Mr. Fuller's rule, stated above, is to "add cement as economy dictates, possibly up to 10 per cent. in excess of the voids in the combined material." The lowest proportion of voids obtained with the gravel and sand used in the above experiments was 19.1 per cent. Addition of this proportion of cement would give a very rich and expensive concrete; about 1 to 5, far beyond anything that could be required for any use except water-tight work. On the other hand, if a volume of cement equal to the calculated voids in the mixture,—13.9 per cent.,—be taken, we shall have 1:7 concrete, of abundant strength for engine foundations or other important uses. Mixtures much poorer in cement, containing 10 per cent. or even 7 per cent. may safely be used for foundations, filling of abutments, etc. If the materials are well selected and correctly proportioned these poor concretes will be found to have surprising strength, and often to be superior to rich mixtures injudiciously combined.

Many series of tests of strength of concrete have been published, but in none of them, so far as we know, have the influence of proportions on density and density on strength, been clearly stated. Such a series of experiments, consisting of crushing tests of 6 cubes of concrete is now in progress under the writer's direction, and results will be published as soon as complete. It is believed that the strength of concrete will be found to be more or less closely proportional to the ratio of percentage of cement to voids, and that mixtures in which the voids are filled to the same degree will be approximately equal in strength. There is, however, another factor which enters into the question, and that is the amount of surface the mixture presents. It is evident that all surfaces must be coated with a film of cement to produce adhesion between them; therefore the greater the surface the more cement will be required.

It is probably chiefly for this reason that coarse materials give greater strength than fine materials.

To sum up the foregoing reasoning in regard to the composition of concrete, we may formulate the following rule for obtaining the best practical results. This is simply an extension of Mr. Fuller's instructions:

Determine carefully the voids in the gravel or broken stone which it is proposed to use; add finer material in the proportion necessary to fill the voids, also in greater and less proportions, and adopt the mixture giving the greatest weight per unit of volume. Add cement in amount depending on desired strength and admissible cost, from a minimum of perhaps 7 per cent. to a maximum equal to the total volume of voids in the mixed materials.

Proportion of Water.—It was formerly supposed that the best concrete was obtained by using very little water, and engineers generally specified that the consistency of the mixture should be that of moist garden earth, and that no water should show until thoroughly tamped. Recently it has been shown that the use of more water—at least enough to make the mass decidedly plastic—gives better results. A paper by Irving Hitz (J. of Western Soc. of Engineers, January, 1901), describes experiments on this point by engineers of the C., M. & St. P. Railway. Three-foot cubes of cement, gravel and stone were prepared, using water to the amount of 44 per cent. and 82 per cent. of the volume of the cement, respectively. The first mixture was merely damp, and was compacted in the box by tamping. The second mixture was liquid, and was poured into the mold without tamping. After thirty days the wet cube was found to be 9.7 per cent. heavier than the dry, and was smooth and dense on the surface, while the dryer cube was rough and porous. On splitting the blocks the wet cube proved to be much harder, and most of the stones were broken along the line of fracture. The dry block, on the other hand, gave an irregular break, most of the stones remaining whole, and the mass showed distinct layers corresponding to the different batches of material.

Another valuable paper on this subject is that by Parkhurst, chief engineer Illinois Central Railroad, in J. West. Soc. Engrs., June, 1902. Dry concrete was found to weigh 136.2 lbs. per cu. ft., medium 151.5 lbs., and wet, 151.4 lbs. The dry blocks easily crumbled in handling. On splitting, the medium and wet blocks were found to be excellent; the dry block poor and not well compacted. Mr. Parkhurst recommends a medium proportion of water, such that the concrete shall quake when strongly rammed, but states that excess of water is better than deficiency.

In the discussion following Mr. Rafter's paper on the theory of concrete, (Proc. Am. Soc. Civil Engineers, Dec. 1899), Mr. Herman Conrow stated that he had found the cost of a wet concrete, laid in place, to be $4.13 per yard, and of dry concrete of the same composition $5.13 per yard. The use of a liberal proportion of water thus effected a saving of 24 per cent.

Mixing and Laying Concrete.—Engineers appear to be generally convinced of the advantage of using a suitable concrete-mixer, instead of hand labor. Where large amounts of concrete are to be mixed the saving by using a power mixer is very great, and there can be no doubt that the danger of imperfect and careless mixing is avoided by use of a suitable machine. The writer has successfully used mixers of the pug-mill type, consisting of a trough with revolving blades. Several excellent machines of the revolving-drum type are in use, and give excellent satisfaction. An ingenious horse-power machine is the "Dromedary mixer," made by the Fisher & Saxton Company of Washington, D. C. This consists of a drum mounted on wagon-wheels, in which the concrete is mixed while being transported to the place of use. For cement mortar, containing nothing coarser than fine gravel, to be thoroughly mixed in batches, the phosphate mixer, made by the Elliot & Walker Company of Wilmington, Del., may well be recommended. This is a revolving pan provided with rotating stirrers; it is very convenient and requires but little power.

In mixing concrete the sand and cement should first be mixed, dry, then the water added, and finally the stone or gravel, previously well wetted, is introduced and the whole thoroughly mixed together.

Large masses of concrete should be laid continuously, by day and night work if necessary, to avoid partings between set and fresh work. If the laying must be interrupted the set surface should be thoroughly wetted and dusted with cement before fresh concrete is applied. This method should also be used in plastering the surface of concrete with cement mortar. A break in a cement floor or sidewalk may be successfully patched in the same manner.

Concrete in Freezing Weather.—Freezing does no harm to Portland cement after the mass has fully set. The hardening of the cement is interrupted by freezing, but proceeds again without hindrance after thawing takes place. Damage from frost is to be feared before the setting, especially if excess of water is used. When work in extreme cold can not be avoided, the sand and water should be warmed and the proportion of water reduced to a minimum. After putting in place the work should be covered with straw or other non-conductor to protect it from frost. Mortar for use in freezing weather is often made with the addition of salt (about one pound to one gallon of water) and appears to give good results. Cement plastering in extreme cold weather should not be attempted.

Concrete in the Baltimore Fire.

An engineer engaged in concrete construction reports to Municipal Engineering that the behavior of concrete in the Baltimore fire was in general very satisfactory. The fire-proof buildings, of which there were, under a strict classification, but six or eight, came through the fire practically intact and, with comparatively little injury to contents. About as many incombustible buildings came through without serious injury, aside from wooden trimmings and partitions, but lost all their combustible contents, in some cases even those in vaults. Apparently most of these buildings had tile floors of some sort, but there were a few floors of reinforced cinder concrete. Nearly all the floors of both descriptions successfully withstood the fire. In several instances the tile floors were broken through by falling safes and other debris, but no failures of the concrete floors on this account were reported by our informant. In fact, the concrete roof of one three-story building successfully withstood the shock and weight of the falling walls of the adjoining higher building, and concrete floors in other buildings developed similar strength. The Commercial and Farmers' National Bank building was a notable instance of the efficacy of a concrete floor. The banking room on the ground floor, which had concrete floor and ceiling, was protected from injury although the roof and two upper floors of wooden construction were destroyed and the debris, including a safe which was on the fourth floor, fell on the concrete floor.

Reports of failures of concrete floors have not yet been reported, but the successes noted prove definitely the value of cinder concrete floors constructed according to the best designs. Their work shows them fully equal to tile floor in resisting fire and superior in strength to resist both shock and the weight of debris.

METHODS AND RESULTS

Grade Crossings in Detroit—Asphalt Bids for Detroit—California Oiled Roads—Convict Labor on Road Materials—Greater Asbury Park—Electric Power for N. Y. C. Railroad—Legislators and Iowa Municipal League—Small Parks for Chicago—Illinois Engineering School—Civil Service Examinations.

Grade Crossings on Dequindre-St. Detroit.

Plans providing for separating the grades on Dequindre-st. have been prepared by City Engineer McCormick at Detroit, Mich. The plans provide for the depression of the tracks from Fort-st. south to Jefferson-ave. At Monroe-ave., the next street north, the tracks are elevated and the street depressed. The heavy grade of the railroad tracks on Dequindre-st. and the hight of some of the streets present great difficulties. The plans provide for the depression of several streets between Fort-st. and Gratiot-ave. from 9 to 17½ feet. This will leave the houses near the tracks up in the air, and the depressions which will be necessary to permit traffic on the cross streets will be from 300 to 540 feet long on both

sides of Dequindre-st. As nearly all of the subways will run to Orleans-st. or beyond, there will not only be depressions in the cross streets, but Orleans-st., the parallel street, will have to be depressed from 2½ to 3½ feet nearly the whole distance from Gratiot-ave. to Fort-st. Although the damages will be enormous, the committee, the city engineer and the railroad men feel that it is not only the sole practicable plan of grade separation, but that it is cheaper than it would be to depress the tracks and bridge the streets.

Detroit's Bids for Furnishing Asphalt.

The city of Detroit, Mich., received bids from nine firms, Feb. 1, for furnishing 1,500 tons of refined asphalt. The Barber Asphalt Paving Company offered to deliver Trinidad lake asphalt at $26, and the Venezuela at $23.90 a ton, which is the lowest price, it is claimed, ever submitted on these two brands. Otto Guelich offered a Turkish asphalt, which is controlled by a French syndicate, at $25 a ton. Los Angeles asphalt was offered at $20 a ton. The Trindad Asphalt Manufacturing Company of St. Louis bid on the crude material at $15,98 a ton, and included five grades of the refined material in its bids, varying from $18.98 to $27.98 a ton. The American Asphalt Rubber Company of Chicago offered asphalt which is 99 per cent. pure and will go 50 per cent. further than the Trinidad asphalt, at $23.50.

Success of California Oiled Roads.

A communication has been received by Clark Alberti, secretary of the department of highways at Sacramento, Cal., from Robert H. Reaney, district and road engineer at Wanganui, near Auckland, New Zealand, in which he states that his attention has been drawn to the successful experiments carried out in California in the construction of permanent road surfaces by the use of oil, and asking for detailed information as to the methods used, and any other facts which would be of service in establishing a similar system of oiled highways in New Zealand.

Secretary Alberti has been engaged for some time in compiling the latest available practical information on the construction and maintenance of oiled roads. Communications received from the supervisors of every county in California indicate that there will be a large increase in the mileage of oiled roads and streets during 1904. The California Department of Highways will later issue this matter in printed form and supply all the road officials in the state.

Convict Labor on Road Materials Proposed in Indiana.

In a recent address before the Farmers' State Congress of Indiana State Geologist Blatchley severely criticised the contract labor system now in force in the state prisons. His subject was, "The Utility of Convict Labor in Making Road Material," which he discussed, in part, as follows:

The contract labor system is a system which often leads to debauchery and corruption of public officers. It is a system that robs labor, destroys factories and turns over to private individuals an asset of labor which should be used for the benefit of the people. The law-breaker owes a debt to the community and any profits accruing from his labor should go to the community.

In order to abolish the evils in the contract system and to improve the roads of Indiana, he advocates the using of the undeveloped deposits of shale and fire-clay which are found in vast quantities and which have been tested and found suitable for making the best paving brick. He favors the purchase of an extensive bed of shale in western Indiana and the erection of a modern brick plant. He would equip the plant with convict labor and put several hundred additional convicts to breaking stone for foundations and cutting it for curbing. This brick and stone could then be furnished at the plant at less than one-sixth of the present prices to the counties devoid of other road material, or, if they are unwilling to buy it, the material could be given to them.

Mr. Blatchley does not give the estimates on which he bases these low figures of cost, but, though the cost may be underestimated, the employment of the convicts will be worth what the excess of expenditure over income may be, even though the road materials are donated to the counties.

Greater Asbury Park.

The residents of the various New Jersey municipalities affected by the proposed plan of consolidation with the Greater Asbury Park will probably vote on the matter March 8. A bill will be introduced by Senator Brown early in March. As submitted, the boundary lines begin at Wesley Lake; thence westerly through

the center of the street to Main street. The lines follow Main street south to the northerly boundary line of Bradley Beach; thence easterly to the ocean, thus excluding Ocean Grove. South they go to the Shark River; thence westerly through the north branch of the Musquash Creek to Reynolds bridge; then back again north along Corliss avenue to Springdale avenue on to West Asbury, to the westerly line of Ivy place in West Allenhurst; thence easterly again along Deal Lake to the southerly boundary line of Allenhurst to the ocean.

Electric Power for New York Central Railroad.

Plans for the entire reconstruction of the New York Central roadbed for a distance of thirty-five miles from the city of New York northward and the elimination of all grade-crossings on the Hudson River and the Harlem divisions have been made and have been submitted to the local authorities of Yonkers, Mount Vernon, Irvington, Tarrytown and Ossining. The work of reconstruction will begin as soon as the necessary consents and agreements of the municipal villages and county officers are obtained. The work will include the laying of an electrical third rail system over and under all the streets, grounds and highways now crossed at grade. Electrical engines, supplied from the power-houses at Yonkers and Fort Morris, will take the place of steam power.

Conference of Legislators with Iowa Municipal League.

Members of the Iowa League of Municipalities met with joint legislative committees recntly and asked for an appropriation of $5,000 for furthering the work of the league. It also recommended several different matters of legislation relative to the government of municipalities, particularly along the line of municipal ownership, to which the members, as a whole, are favorable. The appropriation of $5,000 would be used for the collection of statistics relative to water works, gas, traction and other matters of supreme municipal interest. Considerable attention was given to the matter of remuneration of aldermen, and the feeling seemed to be along the line of larger salaries for aldermen. The passage of a bill was recommended which would make $500 the maximum salary paid aldermen in cities of the second class and $50 the maximum salary paid all others. An additional allowance is to be given under the provisions of the proposed bill for service on the board of review. Legislation providing for a uniform accounting system in cities and for the annual examination of the accounts of cities and towns by the State Auditor, is also proposed.

Small Parks for Chicago.

In discussing the accepted plans of Olmstead Bros. of Boston for the small parks to be established on the South Side in Chicago, Ill., President Foreman of the South Park system recently said:

The new parks will be the best preventive of crime that possibly could be found. Environment is everything in the development of a child, and the children who grow up in the sight of green grass and trees and flowers, and with opportunities to expend their energies in healthy sports and amusements, will not become vicious men and women. The lack of refining influences sends young men into paths of crime. To provide such influences is to provide the foundation of good morals and good morals make good citizenship.

In developing the plans for this system of small parks we have also had the idea of applying the social settlement idea to public institutions. What the social settlement, through the devotion of noble individuals, has accomplished for the people of certain neighborhoods we purpose bringing about through public funds and public agencies. Places where mothers and children can find rest and inspiration for the duties of life, gymnasiums where bodies can be developed into strength and symmetry, and public meeting places where the social instinct shall be developed—these are the things we mean to build.

The fourteen parks that we are about to construct will have swimming pools, gymnastic apparatus of all kinds, ball grounds, boating facilities, sand piles and many other opportunities for exercising young muscles and young activities. One of the chief features will be public meeting halls, where people can get together to hear lectures and hold discussions. This feature alone will be a great help toward bettering the conditions of our congested districts. I am anxious also to have music in the small parks, and provision is being made for this great educational factor of human development in the plans.

The really remarkable thing about the small park plans is the swiftness with which they have developed. Our authority was received from the legislature April 29, when the governor signed the bill enabling us to issue $4,000,000 worth of bonds. Thirty-three days after we had a ratification of the bond issue by the people. We hope to celebrate the first anniversary of receiving our authority by beginning construction on the parks, and

to open some of them on the second anniversary.

The small parks have been selected on scientific principles. We made population maps, showing the congested districts, and located the parks where they were most needed along the lines of future development of residence districts. Further, we have placed them so that they can eventually be adjacent to an extension of the boulevard system. They will thus be of immediate and future benefit. The largest of the parks, between Sixty-seventh, Seventy-first-sts. and California and Central Park-ave., will be as large as Washington Park, and nearer to the center of population of the town of Lake than was Washington Park ten years ago.

Grant Park will be a beautiful setting for a beautiful gem, the Field Columbian Museum. Though the building will be the most conspicious feature of it, there will be delightful lawns, trees and views out over the lake, and a superb drive. It will be one of the greatest panoramas in the world. In two years we expect to have the filling for this park completed. There is money enough on hand for all our work, and we shall not build beyond our means. It will be a question of only a little time before this park is connected with Jackson Park with a boulevard along the lake.

Illinois University College of Engineering.

The President of the University of Illinois and the board of trustees have reached a decision concerning the disposition of the appropriation of $150,000 made by the state of Illinois for the equipment of the College of Engineering. The sum of $30,000 is to be reserved to extend the present equipment for the use of the undergraduate classes. The remainder, after full consideration of the best means of providing opportunities for advanced research and for furthering the interests of the engineering professions and other public affairs, largely managed by engineers and particularly to materially elevate engineering education, will be used to establish an engineering experiment station, which will be the first ever instituted in connection with any state university in this country Two buildings of simple construction will be built as follows:

1. A foundry, costing $10,000, to permit the present forge and machine shops to be enlarged enough to receive the students now in attendance.

2. A steam engineering laboratory, costing $20,000, to contain machines and apparatus for advanced experiments on steam engines and boilers, gas engines, gasoline motors, compressed air, etc.

U. S. Civil Service Examinations.

An important examination will be held April 1, 1904, by the United States Civil Service Commission to secure constructing engineers on the reclamation service of the United States Geological Survey at salaries of $3,600 to $4,800 a year. The subjects for examination will be the applicant's education and training, counting 10 points; his professional experience in general engineering, counting 20 points; his professional experience in construction, counting 50 points, and a technical description in detail of the most important piece of engineering work done under the applicant's supervision, counting 20 points. Personal attendance is not necessary, the papers being sent to Washington. The commissioners expect to have the assistance of a board of eminent engineers in rating the papers.

This form of examination for this class of work is eminently proper and apparently complies with the requirements of the law.

An examination for engineer draftsmen in the supervising architect's office at $1,400 and $1,600 a year will be held at the usual places on April 6, 7 and 8, 1904.

MUNICIPAL AND TECHNICAL LITERATURE

Chicago Damage Suits—Duluth and Nashville Public Work—New Publications—Municipal Reports.

Millions in Damage Suits Against Chicago.

A report was made public Jan. 31 by John W. Smulski, city attorney of Chicago, in which he states that suits for personal injuries, amounting to $38,666,352, are pending against that city. The majority of the suits result from injuries received from sidewalks. An appeal for relief is made to the council, the legislature and finally to the people. Mr. Smulski says in his report that the interests combining to loot the city in this way amount practically to an organization. The names of lawyers, mostly young men, and doctors, occur with great frequency in the lists of suits. He says the piling up of suits will inevitably continue for some years, even should the city at once begin to tear up every wood sidewalk. He says the main cause of this condition is the deplorable state of the city's finances, which makes it impossible to care properly for its streets and sidewalks. The remedy lies in a new city charter, and he points out the many judgments awarded against the city and says that unless favorable action is taken in regard to a new city charter inevitable bankruptcy will result.

Public Work in Duluth, Minn.

The annual report of City Engineer Patton of Duluth, Minn., which has been filed with the City Clerk, states that the street improvements recommended for last year amounted to $2,187,626.12, but it was impossible to accomplish more than 30 per cent. of the work. Mr. Patton recommends the establishment of street monuments in West Duluth, urging that it is almost impossible for the engineering department to do efficient work because of the lack of proper bearings. He recommends sewer systems for Duluth Heights and East Duluth, and states the street monuments and bench marks in these localities have to a large extent been defaced and obliterated. He asks that they be restored and states that the department was unable to do this work last year owing to the lack of funds. Last year a sum of $13,333.30 was appropriated for the engineering department out of the public fund. The value of contract work begun by the city and the estimated value of improvements made by private parties under direction of the department for the year was $226,581.31, divided as follows:

Buildings	$ 11,295.35
Street improvements, paving	135,747.03
Sidewalks	46,532.22
Bridges	11,367.02
Sewers	21,639.69

Mr. Patton says that it is the custom to retain a certain per cent. of the estimate from the contractor to guarantee that the work will be kept in order for five years. During the year 17 miles of sidewalks were built, consisting of 13.93 miles of wooden and 3.6 miles of cement and tile walks.

Public Work in Nashville, Tenn.

The annual report for the year 1903 has been submitted to the board of public works at Nashville, Tenn., by W. W. Southgate, city engineer. During the year the city has expended for special street work, $119,370.08, of which $73,393.92 was contributed by the city, $45,976.16 by the street railway company, and $6,000 by property owners for paving Broad-st. and West End-ave. Street work other than special street work during the year cost $56,397.25, and during the year the total expenditures for special and other street work amounted to $175,767.33. Bitulithic paving was laid on Broad and Woodland-sts. and West End-ave., and granite paving on Bridge-ave. and First and Main-sts. Special sewer work accomplished during the year cost the city $104,849.67, and the total cost of special and other sewer work done during the year was $129,844.15. Mr. Southgate states that during the year 1903 the area of the city has increased

by 337 acres; the length of the streets by 9 35-100 miles; the length of the alleys 3 miles, which was occasioned by the annexation of the new territory in proximity to Centennial Park, known as the Twenty-fifth ward. The total length of streets graded and macadamized during the year was 2 8-10 miles. The total length of both trunk and lateral sewers constructed during the year under the supervision of the engineering department was 8 miles. This makes the total length of all sewers in the city, up to January 1, 1904, 67.2 miles. Mr. Southgate says:

If the present policy of the board in extending the lateral sewers, in so far as funds are available, and as rapidly as trunk sewers are afforded, and in such manner as to carry out a comprehensive system, accommodating entire neighborhoods at one time is pursued, it will not be a great while until the city will be accommodated with a sewer system the equal of any in the country.

The city is frequently put to an unnecessary expense to clear lateral sewers that have become clogged by reason of water closets emptying into the sewer, either without any, or without adequate water fixtures for properly flushing the closets, the result being that the soil lodges in the sewer. I would suggest that the board request the Mayor and City Council to so amend the ordinances governing sewer connections as to forbid that any water closets remain connected to a sewer without adequate water connection to properly flush the closets and sewer out, and fixing a proper penalty for the violation of such a requirement. It would also be well to request the Mayor and City Council to require by ordinance that all closets or privies within a certain specified distance—say 250 feet—of an available city sewer, shall be directly connected therewith by a proper water closet arrangement.

New Publications.

The Testing of Road Materials, including the methods used and the results obtained in the Road Material Laboratory incollaboration with the Office of Public Road Inquiries. By Logan Walter Page, Chief and Allerton S. Cushman, Chemist Road-Material Laboratory, U. S. Department of Agriculture, Washington, D. C.

The road material laboratory is now nearly three years old and its methods of work have begun to take form, and their present state is shown in this pamphlet. Wooden blocks, brick, stone and gravel are tested for hardness, absorption, abrasion, toughness, cross breaking and tensile strength, specific gravity and weight, and cement is tested both chemically and physically. Methods and machinery for all these tests are set forth and many results are given. Forms for making reports and forms for recording street traffic are given. The publication should be valuable in inducing uniformity in testing methods and in making known the facilities for and conditions of public testing in this laboratory.

Critical Review of the Second Series of Analysis of Materials for the Portland Cement Industry, Made Under the Auspices of the New York Section of the Society of Chemical Industry. By W. F. Hillebrand.

This paper is a reprint from the Journal of the American Chemical Society, and is of much interest at this time on account of the active work which is in progress toward uniformity in methods of analysis and test of cements. It is too technical for abstract, but can doubtless be obtained in full on application to Mr. Hillebrand or to the society.

L'Etude des Eaux de Sources. La Fievre Typhoid a Auxerre en 1902. Sources de in Dhuis. Choix de l'Emplacement des Cimitieres. Les Cavernes Penetrables a l'Homme. By Max le Couppey de la Forest, Secretary of the Commission for Study of the Water Supplies of Paris, France.

The first four of these pamphlets are reports of sanitary investigations made by M. de la Forest in the line of his duties. The first and third are studies of spring water and of river sources and the second of a typhoid fever epidemic. The last describes some caves of greater or less extent. M. de la Forest has recently completed a tour of the United States for the purpose of obtaining additional information regarding all these lines and the report of his visit is awaited with much interest.

Water Supply and Irrigation Papers, U. S. Geological Survey, Washington, D. C.

The papers in this series issued since March, 1903, are as follows:

No. 77, on the water resources of Molokai, Hawaiian Islands, by Waldemar Lindgren.

No. 78, a preliminary report on artesian basins in southwestern Idaho and southwestern Oregon, by I. C. Russel.

No. 79, on normal and polluted water in

northeastern United States, by M. O. Leighton.

No. 80, on the relation of rainfall to run-off, by G. W. Rafter.

No. 81, on California hydrography, by J. B. Lippincott.

Nos. 82, 83, and 84, report of progress of stream measurements for 1902, by F. H. Newell.

These titles serve to show to some extent the breadth of the work of the survey and the examination of the pamphlets makes known this practical character, though the preliminary nature of some of them is mainly indicative of what may be expected of the later full reports. Those interested in the subjects treated can obtain copies of the various papers on application to their Congressmen or in some cases to the Director of the U. S. Geological Survey.

L'Etat Actuel de l'Electroculture. By M. E. Guarini, 70 Bvd Charlemagne, Bruxelles, Belgium.

This little pamphlet gives the results of some experiments with the culture of vegetables under electric currents, showing the beneficial effects of certain currents and the methods of applying them.

Index of the Technical Press. Association de la Presse Technique, Bruxelles, Belgium.

The monthly numbers of this valuable publication show constant improvement, and though scarcely a year old are now quite four times the size of those at the beginning. The editors cover the periodicals which they index more thoroughly than any similar publication and give full representation to all branches of engineering. A large number of American and foreign periodicals is now on the list and the price of subscription, 5 shillings ($1.25) a year is no indication of its value. Only a large circulation can make so low a price possible.

Merchants' Association Review, vol. vii, to September, 1903. Merchants' Association, San Francisco, Cal.

The collection of the monthly numbers of the publication of the San Francisco Merchants' Association shows clearly the value of the work done by this public-spirited body, to which the city of San Francisco is most largely indebted for all of the improvements in laws and conditions which have been made in recent years.

The discussion of public questions is free and fair and without fear or favor. It is at the same time a record of what the association does and proposes to do and a field for the discussion of public problems and the formation of public opinion. The public-spirited business men of other cities may well study the methods of this active club and can attain to some measure of its success if they will put into their efforts the same business ability and push.

Nine Feet from Pittsburg to Cairo. By Albert Bettinger, Cincinati, O., 16 pp. and map.

This pamphlet contains a speech by the Hon. Albert Bettinger of Cincinnati before the ninth annual convention of the Ohio Valley Improvement Association at Evansvile, Ind., in October, 1903, and gives the arguments in favor of a nine-foot stage of water from Pittsburg to Cairo. It is full of facts and figures and should have a favorable effect upon public opinion in this direction.

Proceedings of the Twenty-third Annual Convention of the American Water Works Association, Held at Detroit, Mich., June, 1903. John M. Diven, Secretary, Elmira, N. Y.

This volume contains 724 pages without counting the advertising pages, is printed in large and readable type and is well illustrated with a photograph of President L. N. Case and numerous drawings and photographs illustrating the various papers which were presented.

Many of the papers are of much value and the discussions as well as the other proceedings of the convention are given in full.

An arrangement has been made by which the proceedings can be obtained of the secretary, the amount paid for them being credited on his membership fee if the purchaser makes application for membership during the year.

The association is in a flourishing condition and about 350 members and their families attended the convention. The next meeting will be held in St. Louis.

Free-hand Lettering: Being a treatise on plain lettering from the practical standpoint for use in engineering schools and colleges. By Victor T. Wilson, M. E. 105 pp., 13 plates. Cloth, $1. John Wiley & Sons, New York City.

Mr. Wilson has prepared a very satisfactory little book for the beginner on simple lettering. He rightly assumes that the making of a title is an exercise in design and shows the methods of making the approaches to the finished drawing. He, perhaps, assumes too much previous knowledge on the subject for the independent student, and restricts himself closely to the subject as stated.

If combined with Brown's "Letters and Lettering," which was reviewed in Municipal Engineering some months ago, the two books cover the whole field of lettering very satisfactorily.

Hendricks' Commercial Register of the United States, for buyers and sellers. Especially devoted to the interests of the architectural, mechanical, engineering, contracting, electrical, railroad, iron, steel, mining, mill, quarrying and kindred industries. 1,326 pp. Cloth, $6. Samuel C. Hendricks Company, 76 Elm st., New York City.

This is the edition for the year beginning Nov. 1, 1903, of the standard directory of manufacturers, dealers, engineers, architects and all other interested in any sort of construction or in materials and apparatus for construction. The book increases in size each year, an indication that it is keeping up with the developments in business. A measure of this increase is found in the index which, in the last edition ocupied 138 columns, and in this edition requires 168 columns. A little circular of question and answers, which can be had for the asking, shows what the scope of the book is and some of the many uses to which it can be put.

The Mechanical Engineer's Reference Book, by Henry H. Suplee, Member of the American Society of Mechanical Engineers.

This book is published by J. B. Lippincott Company, Philadelphia, Pa. The demand for the book has been so large that a second printing was required before the date of publication of the book, and the publishers are now prepared to fill all orders. The work contains 800 pages, 450 illustrations, and is furnished with a very complete index. It is of pocket size, bound in limp leather, and can also be supplied with a thumb subject-index for 50 cents additional to the regular price, which is $5 net. Fuller notice will be given later.

Municipal and State Reports.

Eighth Annual Report of the Board of Water Commissioners of Atlantic City, N. J., for year ending September 1, 1903. Kenneth Allen, Engineer and Superintendent.

Under Mr. Allen the works, which were recently acquired by the city, have been considerably improved and recommendations for further improvements are made in the report. The summary of statistics is made on the standard form.

The cost of the works has been $1,302,402 and the bonded indebtedness is $1,250,500. The sinking fund now amounts to $31,500. Receipts from water rates have been $52,211 and from bond issue $85,000. Maintenance cost $59,176, interest $57,643 and the sinking fund took $36,211. Construction cost $46,993.

The estimated city population on the lines of pipe is 35,500, but the summer population is more than this by 100,000 to 225,000 persons, ordinarily 150,000. This causes some peculiarities in the consumption. Thus the average daily consumption for the year is 3,967,546 gallons and the average during the summer on the basis of 150,000 additional population is 5,656,335 gallons. The average consumption per inhabitant computed in the usual way is 110 gallons. The summer consumption is 38 gallons and the winter consumption is 94 gallons, computed on the average population for the two seasons.

Monthly analyses of the water are made, both chemical and bacteriological. The water in the Absecon Canal, the source of supply, comes from cedar swamps and there is salt from the sea spray blown inland in storms, which make the ordinary chemical indications of little value. Bacteriologically the water shows well, there being seldom more than 300 bacteria per cubic centimeter, and bacillus coli communis seldom showing a sample of one cubic centimeter, though they always show in quantities of 10 and 20 centimeters. The removal of barns and barnyards on the banks of the reservoir and canal is recommended to insure safety from accidental pollution of a dangerous character.

Fifty-first annual report of the Railroad Commissioners of Connecticut, with statistical tables of steam and street railways. W. F. Willcox, W. O. Seymour and O. R. Fyler, Commissioners, Hartford, Conn.

The railroad statistics are of great value and interest, but room can only be made for a few. The length of road reporting is 4,438 miles, 1,861 miles being in Connecticut. The average cost of the roads was $78,056 a mile, the average capitalization is $78,062 and the average funded debt is $24,557. Gross earnings are $20,748 per mile of road operated, net earnings $5,302 and operating expenses $16,295. The summaries in the report go into detail on maintenance of way and equipment, transportation, traffic and freight, fuel, employes, equipment, accidents, grade crossings, etc. The net earnings are 7.6 per cent. of the total capital stock and indebtedness. Still greater detail is given regarding each individual road, the same for both steam and electric lines.

The street railways show an average cost of construction and equipment of $80,773 a mile of road owned and $66,939 a mile of road operated. Capital stock per mile of road owned is $45,122, and bonds are $34,931 per mile, including sidings. The gross earnings are $6,798, the net earnings $2.021 and the operating expenses $4,777 per mile operated.

An appendix gives the state laws regulating railroads of all kinds and the powers and duties of the Railroad Commission.

Third Report on the Highways of Maryland, by A. N. Johnson, Highway Engineer. Maryland Geological Survey, Johns Hopkins University, Baltimore, Md.

Aside from the reports of the small amount of road improvement done under the present laws, the report contains some valuable work, such as an outline of a county road law prepared at the request of the grand jury in one county. This provides for a board of road commissioners, a roads engineer, supervisors of districts, methods of making appropriations and keeping accounts.

Some tests of paving bricks, comparing the use of old cast-iron shot, new cast-iron shot and chilled steel shot are given, showing percentages of loss in the rattler of 16.2, 17.9 and 20.7 with the three kinds respectively, with a hard brick, and 24.2, 24.5 and 28.3 with a soft brick. The shape of the shot is said to exercise little influence, and the hardness of the brick, in comparison with the difference in equality of material of which the shot is made.

Some tests of concrete bars 6 by 6 by 24 to 30 inches are reported, also some tests on the tensile strength of cement. The latter were made on rings which were pulled apart by exerting air pressure on the inner surface of the rings. The data are not sufficient in number to warrant conclusions as to the comparison of this method with the ordinary briquette method.

Mayor's Annual Message and the twenty-seventh annual report of the Department of Public Works of Chicago, Ill., for 1902. Carter H. Harrison, Mayor; F. W. Blocki, Commissioner of Public Works; John Ericson, City Engineer.

Mayor Harrison discusses the question of street railway franchises and the possibility of municipal ownership of Chicago's street car lines. He is a strong advocate of this method of settlement of the problems now confronting the city administration, in connection with the expiration of street railway franchises. He shows the reasons for the poverty of the city in low valuations and favoritism of officials fixing the valuations and tax rates. The street question is well handled. A compliment is paid to creosoted wood blocks and a municipal creosoting plant at the house of correction is suggested. City work is said to compare favorably with contract work, and contractors' combinations are blamed for high prices, so that it is claimed the only solution of the present difficulties is a municipal department of construction. The work done in removing garbage is commended in this connection. The city has completed by day labor contracts on a land tunnel of the water works and one of the tunnels under the lake which had been abandoned by the contractors and has also constructed by day labor two water pipe tunnels and is now building a lateral intercepting sewer. In all these cases the Mayor gives comparisons showing the superior results of the municipal construction, and especially the saving in cost. The civil service is commended. Track elevation, subways, pneumatic tubes, strikes and social problems have their full measure of attention.

Fifth Annual Report of the Board of Water and Light Commissioners, Duluth, Minn., 1903. L. N. Case, Manager and Secretary.

The earnings of the department for 1903 exceeded the expenditures for operation, maintenance and interest charges by $32,000. The accumulated earnings of the department are $90,000, nearly all of which has been applied on construction. The demands for extensions are greater than can be met in this way and $50,000 additional is desired, which would be added to the bonded indebtedness. Extensions are only made when the guaranteed income from them will pay 8 per cent. on the cost, but the cost is computed at $1.50 a foot, that of pipe for local service, and when the necessities of the distribution service require larger pipe, the board considers the additional cost properly a charge upon the system at large. Rock excavations sometimes make a similar extra cost which is taken care of in the same way. The result for the year 1903 was that the income from extensions laid that year pays only 6.4 per cent. on the total cost, instead of the standard 8 per cent.

The West Duluth plant was purchased in 1902. Municipal operation has resulted in a profit to the city of nearly $8,000 at the same time that rates were reduced 23 per cent., thus saving to the water

consumers $2,648, or a total profit of more than $10,000.

A new pump is one of the necessities of the immediate future.

The board also operates the city gas works, which earned $4,584 of the surplus given.

A contract has been made with the Zenith Furnace Company to furnish gas to the city for its distribution, at a price slightly less than the cost of making gas in the city's own plant. The surplus is $3,000 greater than for the year before, although the higher price of coal added $3,572 to expenses and the reduction in rates from $1.15 to $1 made a reduction in receipts of $5,272.

A court decision has established the power of the board to install water meters wherever it suspects waste of water.

An interesting table gives the cost of making gas and the amount of gas lost and unaccounted for. The monthly averages of cost of gas actually made range from 37¼ to 50 cents per 1,000 cubic feet, and the gas not acounted for varies from 3½ to 18 2-3 per cent. of the amount made.

ORGANIZATIONS AND INDIVIDUALS

Michigan Municipal Societies—Electric Club—Technical Club—Personal Notes.

Convention of Michigan Municipal Societies.

The Michigan Political Science Association and the League of Michigan Municipalities held a joint convention in Ann Arbor, Mich., Feb. 11 and 12, at which there was earnest and careful discussion of some important municipal problems.

Municipal ownership of public utilities was discussed pro and con by F. F. Ingram and C. A. Kent of Detroit.

Prof. Kent is the president of the Political Science Association. He took a decided stand against the public ownership, on the ground that the interest of the workers is destroyed if they are employes of a government.

Private enterprise safeguards itself at every step along lines of economy and efficiency, but in governmental affairs these precautions are sensibly relaxed. Even if the public officials are honest and well meaning, private affairs and the necessity of maintaining their political standing interfere very greatly with their administration of their public duties.

Another argument is that public ownership tends to an increase of taxation, by removing taxable enterprises from the field.

Thirdly, public ownership tends to make the government all powerful, which is contrary to our 9nglo-Saxon principles.

The advocates of public ownership of public utilities, are obliged to go to Great Britain for example of their theory, and then the question is still subject to debate. In Glasgow the most striking example, the taxes have increased greatly during the past decade.

Municipalities are popularly supposed to treat their working men better than do private enterprises, and their argument naturally appeals to the poor.

One who would radically change the great machinery of society had better look carefully to what he does. At what stage in the process of acquiring wealth does a nobleman worry his fellows? He works himself up from the bottom by organizing and developing enterprises that give employment to workmen. The poverty of the multitude is a great evil, but in this country at least its main cause is the willingness to live on a bare subsistence. For the mass of the poor the only real help is the instilling of new wants and the creating in them of the industry necessary to gratify these wants. Business seems doomed to vibrate between too great competition and too great combination. The extreme of socialism is unthinkable, but the scope of government may be greatly increased.

There is a limit to the amount of taxation, as people cannot pay taxes unless their income is enough larger to allow them to live on the difference. Contests

as to wages are really contests between different classes of workers, as the consumer pays for any increase in the cost of production. Combinations of capital under government would have the same evils as the trusts.

Mr. Elmer Swarthout of the Grand Rapids city council, read an interesting paper on "Some Requisites of a Good C..y Charter." The first part of this was a discussion of the place which should be given to the council in the scheme of municipal organization. After considering the plans for centralizing all power in the hands of the mayor and for establishing bicameral councils, Mr. Swarthout disapproved of both. He believed in a single council with large power. This would be more economical than the bicameral system, would fix responsibility and would avoid the confusion which exists where the ordinance power is distributed among various boards and officials. This would be following the same plan as private corporations, where the board of directors is the general policy determining power. At the same time the council should not have executive or administrative powers; but these should be centered in the control of the mayor.

The latter part of the paper discussed charter provisions in reference to franchises and street improvements. On both subjects the provisions of the Grand Rapids charter were critised, and those of the recent charter of Portland, Ore., were cited aprovingly. In reference to franchises, these limit the terms of franchises to twenty-five years, require public notice and a two-thirds vote of the council to grant a franchise, provide for public reports from the franchise company, authorize a referendum on all franchises on the petition of 15 per cent. of the voters, and empower the city to own and operate public utilities. Mr. Swarthout did not favor municipal ownership of street railways, but legal authority to do so, as a means of controlling the franchise corporations.

He did approve, however, of cities owning and leasing the street railway roadbeds.

Papers were read on "Public Works in Detroit," by Commissioner W. H. Maybury and on "The Separate System of Sewers for Small Cities," by Mayor E. R. Nellis of Wyandotte, and Dr. V. C. Vaughn talked on "Walter Supplies." Senator Simons presented a paper on "Direct Primary Elections." He said:

Against the system as applied to a municipality there can be little valid objection. It is free from any of the more important objections that are urged against its application to larger and differently constituted communities. It is sound in theory and has proved effective in practice. Still better results may be expected as the weaknesses of the law appear through repeated application and are remedied. For my own part I am confident that it will do more to reform our municipal governments than any other change suggested or projected. The reform in the nominating system is a fundamental reform, for nearly all public ills may be traced to the initial step in the choice of public servants.

The Ohio Municipal Code was explained by M. G. Denman, city solicitor of Toledo. The progress toward uniformity in municipal accounting was recounted by Charles Carroll Brown of Indianapolis, editor of Municipal Engineering, special attention being given to the new Ohio law. The work of the Wisconsin league was described by Prof. S. E. Sparling, its secretary.

The social features were not neglected. Such meetings as this are fruitful of results beneficial to the government of the municipalities of the state and country. Prof. J. A. Fairlie, the secretary of both organizations, was largely responsible for the high character of the papers presented and for the general success of the convention.

Technical Meetings.

The fourth annual meeting of the Wisconsin Clay Workers' Association will be held at Portage, Wis., March 1, 2 and 3.

The twenty-sixth annual convention of the Illinois Clay Workers' Association was held at Danville, Ill., January 5 and 6. Among the papers presented were the following: "Civic Improvements," D. H. Jansen, Pekin, Ill.; "Necessary Sizes of Drain Tiles," L. R. Whitney, Terre Haute, Ind.; "Road Construction," F. S. Selley, Danville, Ill.; "Power Generation for Brick Plants," John T. Thompson, Chicago. Officers for the ensuing year were elected as follow: president, Frank W. Butterworth, Danville, Ill.; vice-president, O. W. Dunlap, Bloomington, Ill.; secretary, George H. Hartwell, Chicago; treasurer, William Hammerschmidt, Lombard, Ill.

The tenth annual convention of the Minnesota Good Roads Association was held at St. Paul, Minn., February 23.

The fifth annual convention of the

boards of supervisors of the state of New York was held at Albany, N. Y., January 26 and 27. Officers were elected as follows: chairman, Hon. Eugene L. Burnette, Ontario county; secretary, H. E. Cook, Lewis county; vice-presidents—Peter Walker, Albany county; Una A. Pollard, Broome; F. E. Whitmore, Cortland; Geo. H. Butterfield, Chenango; James A. Woodward, Erie; E. V. Decker, Herkimer; A. Bickelhaupt, Jefferson; Adam Kotary, Lewis; J. Y. McClintock, Monroe; T. R. Staley, Montgomery; F. E. Swancott, Oneida; John Schumann, Jr., Rensselaer; Joseph S. Barnes, Seneca; Phillip Shautz, Ulster; Dr. Wm. C. Smith, St. Lawrence.

The next annual convention of the National Good Roads Association will be held in St. Louis, May 19, 20 and 21. Practical demonstrations of road making methods will be given during the convention.

The twelfth annual convention of the Northwestern Electrical Association was held in Milwaukee, January 20, 21 and 22. Officers for the ensuing year were elected as follows: president, T. F. Grover, Fond du Lac, Wis.; vice-presidents, George H. Lukes, Evanston and F. A. Daniel, Menominee; secretary-treasurer, Thomas R. Mercein, Milwaukee.

The eighteenth annual convention of the National Brick Manufacturers' Association was held at Cincinnati, O., Feb. 1 to 13 inclusive. Among the papers presented were: "Neglected D etails in Brick Pavement Construction," Prof. I. O. Baker, Champaign, Ill. and "Brick Pavements, or the Permanent Improvement of City Streets," W. E. Gunn, C. E., Covington, Ky.

The nineteenth annual meeting of the Illinois Society of Civil Engineers and Surveyors was held at Champaign, Ill., Jan. 20, 21 and 22. Prof. Ira O. Baker opened the meeting with an address of welcome to which President John W. Alvord responded. An address was then delivered by Dean N. C. Ricker on the College of Engineering of the University of Illinois. The annual address of President Alvord, on "Harnessing the Forces of Nature for the Use of Man," followed. In the absence of F. E. Herdman, his paper on "Municipally Owned Water, Gas and Electric Light Plants," was read by the secretary, and the methods employed by Winnetka to furnish its residents with light and water were described. The practical uses of concrete on the farm were described by L. Z. Jones. O. L. Gearheart submitted a paper on "Concrete Foundations for Pavements."

The sixteenth annual meeting of the Iowa Engineering Society was held in Des Moines, January 20, 21 and 22. A paper on "Nishnabotna River Improvements" was read by Seth Dean of Greenwood; "Street Grades" by Prof. L. Higgins of Des Moines; "Experiences of a County Surveyor," I. W. Hoffman of Carroll; "The New Melan Arch Bridge at Waterloo," W. L. Newton; "Sanitary Engineering," Prof. C. S. Magowan of Iowa City; "Official Methods in Structural Iron Works," Prof. L. E. Ashbaugh of Ames; "Railway Construction from the Resident Engineer's Standpoint," Prof F. C. French of Ames; "Electric Power for Railways," Prof. B. S. Lamphear of Ames.

The Engineers' Club of Columbus, O., elected officers February 6 as follows; President, W. F. McGruder; vice-presidents, W. T. Guy and W. K. Danman; secretary, H. M. Gates; treasurer, Wm. Michael.

The Engineers' Club of Philadelphia, held a meeting February 20 and a paper on "Reinforced Concrete in Building Construction." was read by E. G. Perrott.

Personal Notes.

John E. Reynolds has been elected Mayor at Meadville, Pa.

J. W. Barnett has been reappointed city engineer at Athens, Ga.

T. J. Moreland has been re-elected city engineer at Knoxville, Tenn.

J. P. Ogden has resigned as first assistant city engineer at Cleveland, O.

Edward Lynch has been reappointed fire commissioner at Fall River, Mass.

Hon. John A. Roche, former mayor of Chicago, Ill., died suddenly February 10.

William Gavin Taylor has been reappointed city engineer at Medford, Mass.

Robert Hoffman has been appointed first assistant city engineer at Cleveland, O.

Robert Clark, jr., has resigned as a member of the council at North Plainfield, N. J.

Daniel Phillips has been appointed councilman, to succeed C. U. Davis, at Glenville, O.

Walter W. Crosby has accepted the general superintendency of parks at Baltimore, Md.

John F. Sprenkle has been elected superintendent of the Lehigh Water Company, at Easton, Pa.

Park Woodward has been re-elected general manager of the water-works department at Atlanta, Ga.

William Mayer, alderman and chairman of the finance committee of city council at Chicago, Ill., died February 12 of apoplexy.

David Hoover has been re-elected superintendent of the Waynesboro Water Company at Waynesboro, Pa.

J. S. O'Connell has been appointed chairman of the Board of Water Commissioners at Marlboro, Mass.

George Dwyer has been appointed city engineer and Thomas J. Schoenlaub assistant city engineer at Marion, O.

Rufus Beeye has been reappointed a member of the water commission for a term of three years at Atlantic City, N. J.

Arthur J. Cox, secretary and treasurer of the Iowa Engineering Company, Clinton, Ia., will have his office at Iowa City, Ia.

Christopher Harrison has been reappointed city engineer at Everett, Mass. This is Mr. Harrison's seventh consecutive term.

David A. Hartwell has been re-elected city engineer at Fitchburg, Mass. Mr. Hartwell has held this position for thirteen years.

J. O. Magruder has been elected city engineer and Frank Talbott superintendent of water works and electric lighting at Danville, Vr.

Mr. Edward B. Ellicott, city electrician of Chicago, has been appointed chief electrician and mechanical engineer of the Louisiana Purchase Exposition.

George H. Boughman has been re-elected city engineer and James L. Zeigler and William E. Snyder first and second assistants, respectively, at Wilmington, Del.

Bertram Brewer has been reappointed city engineer, Richard A. Jones superintendent of streets and Leroy Brown superintendent of water-works at Waltham, Mass.

O. C. Simonds, landscape engineer, of Chicago, Ill., addressed the Woman's Club of Moline, Ill., February 15, on "Town Improvement or Beautiful Surroundings."

Asa B. Prichard has been appointed commissioner of streets at Somerville, Mass., to succeed his father John P. Prichard, who has held the position for nearly eight years.

John H. Kelman has resigned his position as superintendent of the Stanley Electric Company of Pittsfield, Mass., to accept a position with the Allis-Chalmers Company of Chicago, Ill.

George A. Clark of East Boston has been appointed engineer for Simpson Bros. Corporation, 166 Devonshire-st., Boston, to conduct the business of its steel-concrete construction department.

Russell L. Dunn has been appointed special assistant engineer for the Board of Public Works at San Francisco, Cal., in an investigation for fixing the water rates of the Spring Valley Water Company.

C. F. Berger, formerly with the Sandusky Portland Cement Company, is now the Chicago sales agent of the Atlas Portland Cement Company, with offices in the Marquette building.

John Geist has established an office as consulting engineer at 38 Exchange Building, Milwaukee, Wis. Mr. Geist has been acting as engineer of the Milwaukee plant of the American Bridge Company.

T. Chalkley Hatton, M. Am. Soc. C. E., has resigned as consulting engineer to the sewer department of Wilmington, Del., and will devote all his time to private practice.

Arthur W. Tidd has accepted a position as assistant engineer with the Charles River Basin Commission. Mr. Tidd has been recently engaged in work for the commission on additional water supply for New York City.

Frederick A. Waldron, formerly superintendent of power and plant at the works of the Yale & Towne Manufacturing Company, at Stamford, Conn., has established himself as a consulting engineer in power plant construction.

Mazyck Ravenel has been sent to Charleston, S. C., by the American Pipe Company to make an analysis of Goose Creek water, and as soon as completed the result of his investigation will be reported to that company.

Albert E. Greene, a practicing engineer and the son of the late dean of the engineering department of the University of Michigan, Charles E. Greene, has been appointed as assistant professor of civil engineering to take charge of the class work formerly done by his father. A successor to the deanship has not yet been appointed.

Dr. Kiosaburo Futami, professor of civil engineering in the Kyoto Imperial University, Japan, arrived in Boston, Mass., February 2. He will study certain branches of civil engineering, and particularly the bridges of the largest cities, while in this country. Dr. Futami is making his headquarters with the American Society of Civil Engineers in New York City while here.

MACHINERY AND TRADE

St. Louis Bitulithic Contracts Upheld by Supreme Court.

The Missouri Supreme Court rendered a decision on Feb. 24 upholding the Board of Public Improvements of St. Louis in the matter of paving W. Pine-boulevard with bituminous macadam.

William F. Swift, one of the property-holders along the way of the proposed improvements, sought to invalidate the special tax bills because the city authorities specified Warren's bituminous macadam. The court holds that the Board of Public Improvements had authority, under the charter of the city, to so specify.

The decision sustained the judgment of Circuit Judge Wood, who, in giving his decision, said: "The testimony strongly tends to show that there are no manufacturers in the United States manufacturing coal tar cement for street paving purposes other than that manufactured by the Warren Bros." This statement the Board of Public Improvements quoted in their answer to the request by the House of Delegates for a statement in regard to why certain Warren's materials were specified in street bills in preference to other materials, which, it was claimed, barred competition on street work. Warren's waterproof cement, which is used in mixing the ingredients of bituminous macadam, is patented by the Warren Bros., and, according to the board members, is the best waterproof material ever submitted for paving purposes, and therefore had been recommended by them in construction work, where the board's discretion had been called upon.

Judge Gantt wrote the decision.

A report of the decision of the lower court, which is now affirmed by the Supreme Court, will be found in Municipal Engineering, vol. xxiv, p. 284.

Development of the Automobile.

The rapid and progressive growth of the automobile industry within the past ten years has had great influence on engineering problems. These vehicles are and have been one of the factors helpful to the movement for better roads and paved streets. The industry has opened a new industrial field for manufacturers and mechanical men. The problems that have been solved in connection with the automobile as a pleasure conveyance are now being adopted for every day, practical use. The plow, lawnmower, truck, reaper, fire-engine, street-sweeper, street-sprinkler, and many other horse-drawn vehicles have been the medium for application of power for self-propulsion.

The two great automobile shows of the year have been held at New York and Chicago, each of them giving a splendid idea of the advancement of the industry. Neither show exhibited anything radically new, although many builders and designers have changed their methods of construction. Foreign ideas are being taken by Americans and blended with our own methods, with the consequent increase in strength and utility.

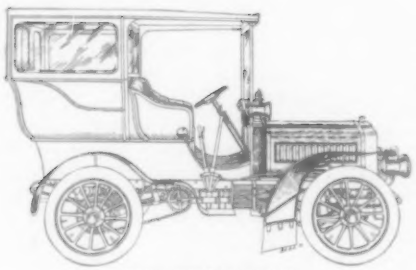
The present tendency is toward the increase of power and the decreasing of weight in ratios that add strength, power and speed to machines. All manufacturers are endeavoring to bring the weights of their machines within the limits of one horse-power for every hundred pounds of weight or less.

The Chicago show emphasized the fact that the two-cylinder double opposed, and three and four-cylinder vertical motors are being universally recognized. The single cylinder engine has been discarded on all machines with the exception of runabouts, the main objection to it being its excessive vibration and the inability satisfactorily to construct single cylinder motors of over eight to nine-horse power, although the style is simple to operate and gives little trouble. The two-cylinder double opposed engine is especially well adapted to hilly country and bad, rocky roads, where large power is desired, but not great speed. This type gives very little vibration and propels a machine very smoothly. Many prominent firms exhibited cars with this style motor at Chicago. Among whom were such firms as the Winton Company, Haynes-Apperson Company, Stearns Bros., Kirk Manufacturing Company, Apperson Bros., and the Ford Company. It was a noticeable fact at Chicago that

many new companies were following the lead of these older concerns and building cars with this same type of motor.

Quite a number of firms exhibited two-cylinder vertical engines. This is an economical engine and gives very good service, but it has been found exceedingly difficult to attain perfect balance for the reason that the cranks are necessarily opposed, while the cylinders and pistons are not, both being vertical. The positions of cranks and pistons consequently give the engine irregular impulses when an explosion occurs.

One of the newest and most thoroughly built cars and one that in all probability was surrounded more continually than others by mechanical engineers and enthusiasts was a three-cylinder machine. Although several American firms have been rather unsuccessful with this style of motor others have proved it is entirely practical and very serviceable. Prominent foreign manufacturers, such as the Panhard-Levassor Company, are making a special feature of their three-cylinder motors. This engine gives almost perfect balance, with one-third less of wearing parts than a four-cylinder, is one-third less complicated and burns one-third less fuel, to say nothing of the decrease in trouble with valves, ignition, lubrication, bearings and coolings. Above all, and perhaps one of the most important features, it is less expensive than the four-cylinder motor, which gives the same results in regard to power and balance, but with the additional drawbacks mentioned. The three-cylinder motor was exhibited in such numbers at Paris that it was pronounced one of the features of the show.



THE THOMASINE.
Instantly Convertible Into Inclosed or Open Car Without Alighting.

The machine mentioned as being such a decided success at Chicago in the three-cylinder line was one manufactured by the E. R. Thomas Motor Car Company of Buffalo. They have embodied in their car all the important details of mechanical construction and have at the same time provided for the safety and comfort of the tourist. Their three-cylinder motor develops twenty-four horse power at a normal speed of 900 revolutions per minute. The cylinders are cast individually, facilitating ease of repair in case of necessity. The power is transmitted through a very neat sliding gear transmission, with three speeds forward and one reverse, the drive being direct on the high gear, with no gears meshed. A countershaft, bevel geared to the transmission, then carries the power to the rear wheels through two side chains. Safety devices are numerous throughout the car, making it simple and safe for the most careless chauffeur. Three brakes are provided, one on the differential shaft and two on the rear wheels attached to drums. All brakes may be applied, the clutch disengaged and the throttle released by applying the emergency brake. Another feature that appeals to drivers in hilly country is the device that absolutely locks the rear wheels if through any mishap the car should begin to travel backward on a steep and treacherous incline. This is accomplished through the use of a pawl and ratchet in each brake drum on the rear wheels.

The Thomas people seem to have solved the problem of winter and summer touring with the introduction of their new six-passenger limousine body. This body is of beautiful design, resembling the usual canopy topped car, but the tonneau is very ingeniously inclosed in plate glass that may be taken out or put in with little trouble. A hot water pipe is run through the tonneau for the comfort of the occupants in cold weather. A plate glass is placed in front of the chauffeur and side curtains are provided for his protection.

With all of these features the car averages eighty-three pounds of weight for every horse power, thus making it one of the lightest of the high-power machines at the show.

Many cars were equipped with four-cylinder engines, ranging from sixteen to sixty horse-power. In fact, the general tendency seems to be toward four-cylinder motors. They give very little vibration with light power but are necessarily more complicated and more expensive than the three-cylinder engine. The four as well as the three-cylinder motors are very smooth, quiet-running engines. The majority of them are so well muffled that the noise due to the explosions is not noticeable, and only a slight sound of the

moving machine comes from the chains and transmission.

Foreign manufacturers are using the four-cylinder engine to a great extent and the American designs are following their lead. R. F.

A Successful Type of Dump Wagon.

The accompanying cut shows the Hoosier dump wagon, which is manufactured by the Studebaker Brothers' Manufacturing Company of South Bend, Ind. The cut shows most of the points of interest in the wagon, with its latest improvements, including the turn-under front gear and the levers and chains by which the driver can operate the dumping mechanism without leaving his seat. The Studebaker guaranty goes with this wagon, as it goes with all their vehicles. The company can furnish on the shortest notice any description of dump wagons, contractors' carts, garbage wagons, street sprinklers, street sweepers or other municipal vehicles of any sort. It has the reputation of keeping all its vehicles up-to date, equipping them with all the latest improvements.

THE STUDEBAKER DUMP WAGON.

Stone Making by the Lake Process.

Three patents have recently been issued to Mr. Albert Lake for molding artificial stone, which are the result of some years of experience in molding such stone and embody the ideas which he has developed as a result of this experience. One of these patents, No. 743,525, dated November 10, 1903, describes a method intended to produce a stone free from craze or surface cracks and having a smooth surface which can be used without tooling, or can be tooled in any manner desired. The special feature of the method is the filling of the mold partially with water before putting in the concrete mixture for making the stone. The mixture may be fed in dry or of desired consistency, and as it is deposited the water rises in the mold and when the stone is finished the water stands a fraction of an inch deep upon the surface. After about twenty-four hours the water has nearly disappeared, the mold can be removed and the stone is cured for any desired period before using.

The claims for the stone made in this way are that it is nearer the natural stone in appearance and color, that it is close grained enough to be waterproof, that it can be cut or ornamented like stone, has greater tensile strength than stone and is otherwise much stronger.

Blocks are made solid or hollow of any desired shape or reasonable size and with all sorts of ornamentation of face.

The wet process is used so that no tamping is necessary, and no acids are used. The process is simple and inexpensive and the product as stated above is claimed to be superior. Crushed stone and Portland cement are used and hollow blocks, plain or tooled face, are made for foundations and walls of plain buildings. Heavier and finer blocks with rock or tooled face are made for higher class building walls. Blocks of any size or shape, solid or hollow are made to suit any class of buildings for trimmings or for walls. The price of the common foundation blocks is low enough to permit competition with common brick. The walls of a building can be furnished complete from bottom of foundation to roof, or any part, including window and door

sills and lintels, belt courses and cornices frieze, columns, capitals, pilasters, balustrades, posts, steps, caps, coping, chimney caps, as well as any ornamental or useful objects usually made of stone of iron, terra cotta and other materials.

Montfort and Weaver, 45 Clinton-st., Newark, N. J., are the general sales agents for territory and appliances for operating under the Lake patents.

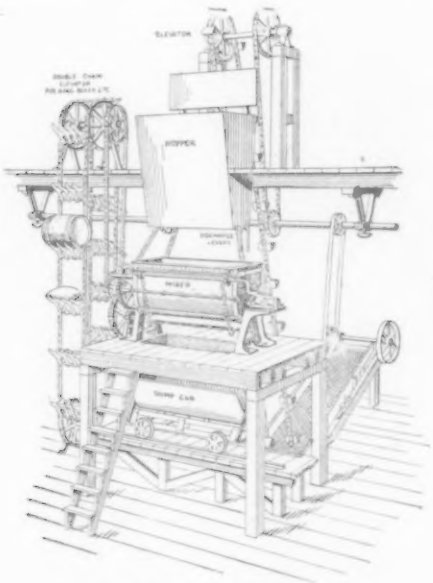
Artificial Stone Making.

In the rush to make a machine that would produce concrete building blocks, the most essential feature, that of producing a sound, correctly-formed block has often been overlooked. The Standard Sand and Machine Company, Cleveland, O., instead of rushing on the market last season put in the year in developing a block that is pronounced correct by engineers and architects. With the assistance of thorough machinists they built several machines, and blocks produced by them were put to the most severe tests possible. The block standing the highest test was the one selected. This block has a vertical air space 2½ inches wide and a 1½-inch binder (withe) every 4 inches, enabling the manufacturer to make blocks of uniform strength and of any desired length of 4 inches or longer. This block has also a horizontal groove 1 inch high and 4 inches wide on the under side of each block, thus connecting all vertical air spaces as well as forming a convenient hand-hold for the mason in laying the wall.

This form of hollow block is made in all sizes and shapes desired in building construction with one machine, a great saving in first cost to a concrete block manufacturer. The machine is built of iron and steel in a most thorough manner and has no complicated mechanism. It has few parts and a large range of adjustments. All width blocks are made with one size pallet, which feature alone is a great saving in the purchase price of a machine. Newly-made blocks are delivered upon the side, thus seasoning them without a single crack or break in the withes (bonds). Face designs are made with a simple interchangeable panel device requiring but a few moments. They furnish rock face, bevel panel, plain and any special design. Parties contemplating the purchase of a hollow concrete building block machine will find it to their interest to communicate with this firm.

They also manufacture mixing, conveying, screening and drying machinery for the complete equipment of concrete block and wall plaster plants. Molds for making special ornamental work, etc., are furnished to the trade.

The accompanying cut shows one of the



CONCRETE BLOCK MACHINE
Of the Standard Sand and Machine Co., Cleveland, O.

many plans of mixing plants installed by this firm.

A Prismatic Drum Concrete Mixer.

The Stanley Prismatic Drum Concrete Mixer is a new candidate ror popular favor, put on the market by the Contractors' Plant Company of 37 Pittsburg-st., Boston, Mass. This is a batch mixer adapted to steam, gasoline or electricity for motive power. It is driven from both sides with considerable saving in power and in wear and tear, and is said to be the only concrete mixer so driven. The drum is an octagonal prism with the circular driving gears at the ends. Deflectors are attached to the plates of the machine in such way that the concrete mass is not only turned over by the revolution of the prism on its axis, but is thrown from side to side, thus giving the same effect as a cubical box swung from two opposite corners.

Barrows dump the material into one end of the machine. At the other end of the machine is a chute which in one position keeps the material in the drum, but by throwing a lever it drops into position to receive the material as it comes to its upper end and discharges it into a barrow or pile outside. The water is fed by automatic measurement. The drum continues its revolution without stop either for loading or discharging.

The capacity of this mixer is rated according to the product turned out, not according to the amount of materials put in. Thus a mixture of 5 cubic feet of cement, 12½ of sand and 26 of stone make 43½ cubic feet of materials, which is used as the measure of capacity of some machines. These materials make but 27 cubic feet of concrete or one cubic yard, and this is the rating of the Stanley mixer. The half-yard machine will hold materials enough to turn out 13½ cubic feet of concrete in one batch.

The machine is lighter than similar machines, but this lightness is not secured at the expense of strength. The drum runs so easily that, when empty, it can be revolved by one hand.

This company also manufactures a very satisfactory gravity concrete mixer.

The Stewart Cement Block Machine.

One of the simplest machines for making cement blocks is that put on the market by the Stewart Cement Block Machine Company of the Lafayette Building, Waterloo, Iowa.

The whole machine is operated with one lever. Throwing this lever down lowers the core, opens the sides and ends and raises the block out of the machine ready to be taken away. Throwing the lever back to place sets the machine ready to make another block. One movement is all that is necessary for each of these operations, for the machine is self-locking. The machine has no hopper, but is provided with an adjustable table level with the top of the box, which opens out of the way by the same motion which opens the mold or box. It is said that three men will make from 250 to 300 blocks a day with this machine.

Full-sized blocks of 8 by 24-inch face and 8, 10 and 12-inch width can be made, also fractional blocks 4, 8, 12 and 16 inches long.

The rapidity of action of the machine and the small number of men needed are said to make it possible to turn out blocks at lower cost than has heretofore been thought possible.

Machinery for Cement Blocks and Posts.

The Cement Machinery and Manufacturing Company of Burlington, Ia., is an organization formed to supply the rapidly growing demand for machinery for making various kinds of cement and concrete blocks, posts, etc.

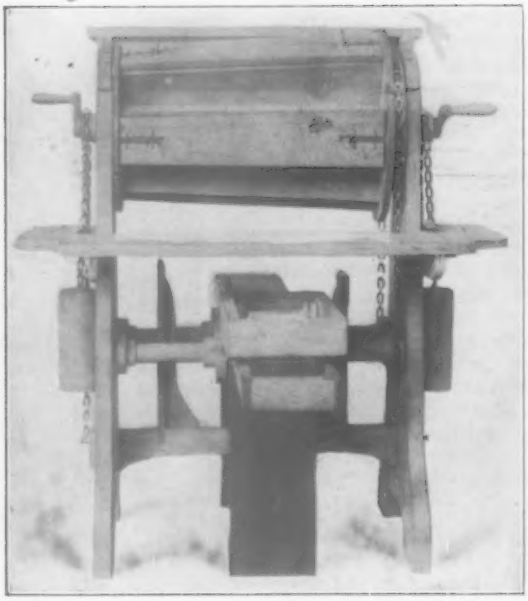
The Chicago block machine of this company will make hollow or solid blocks and is adjustable for any sizes of blocks up to 48 inches long, 18 inches wide and 12 inches high. It will also make corner, pier, flue, circle and octagon blocks. Any desired design of face can be used.

Their Burlington rotary block machine will do the same work and it automatically releases the block from the mold, loads it on a car and runs the car, so that one man can operate the machine. The only handling necessary is to stack the cured blocks.

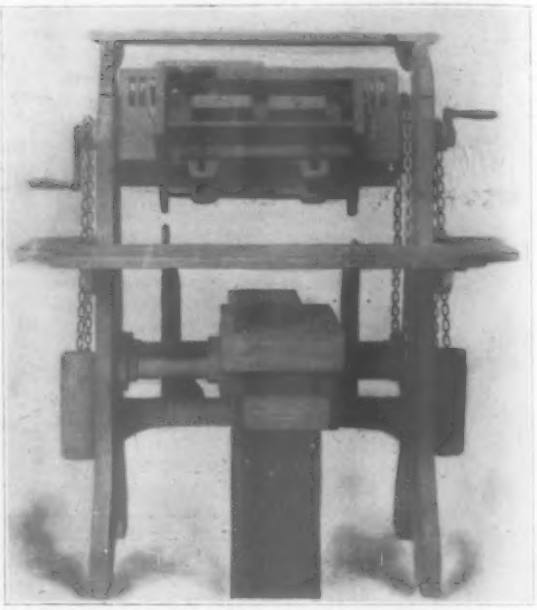
The Burlington rotary post machine has the same car system as the block machine. It makes fence posts, which can be reinforced with any number of wires, the clips being placed at any desired distance apart. One man can make from 100 to 150 posts a day 7 feet long and 4x4 and 2x4-inch dimensions at the two ends. The cuts on page 210 show the three machines mentioned.

The company also has a sidewalk block machine adjustable for any thickness of block up to six inches and any size from 16 inches to 36 inches square. This machine can also be used for pier and flue blocks.

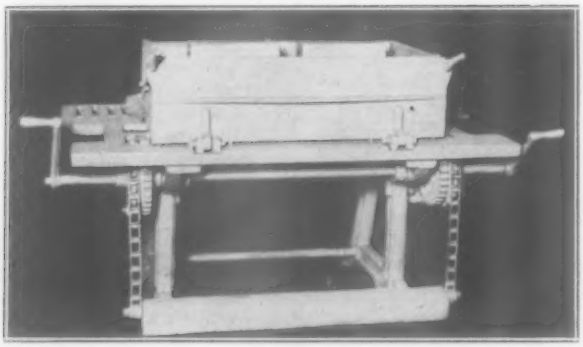
With the Burlington brick machine



The Burlington Rotary Post Machine.



The Burlington Rotary Block Machine.



The Chicago Cement Stone Machine.

CEMENT BLOCK MACHINES OF THE CEMENT MACHINERY AND MANUFACTURING COMPANY, BURLINGTON, IOWA.

from 15,000 to 20,000 bricks of standard size can be made in a day, it is said.

The Burlington sewer tile molds are of heavy sheet steel reinforced with band iron and have heavy cast caps and bases. They are made in stock sizes for pipe of 6 to 30 inches diameter, but can be made of any size desired. Tank molds designed on like principles can be furnished of any desired diameter.

The company also manufactures a solution which is said to make cement stone impervious to water. It can be applied by brush or sprayer.

The business of the company also includes the sale of engines, concrete mixers, Portland cement and other necessary machinery and materials.

LAW EXCHANGE, JACKSONVILLE, FLA.
Built of H. S. Palmer Hollow Blocks.

A Pioneer Cement Building Block.

The use of cement building blocks as a successful substitute for wood, brick, terra cotta and stone, as a real factor in the building world, is of most recent growth, though the crude idea is many years old. Durability is conceded, provided the blocks are made right by right people of right material by right machines and methods. It is clear that, when a manufacturer of cement block machines sells a machine he does not provide brains or common sense for the buyer. The maker of blocks must know something about cement, its qualities and methods of manipulation.

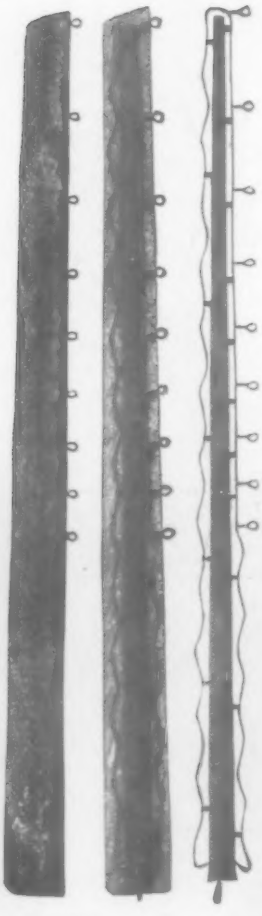
Harmon S. Palmer of Washington, D. C., may well be termed the pioneer in the field of cement block construction and use. His first cement block building was erected about sixteen years ago and is today one of the best evidences of the practicability of the method he has done so much to develop. There were many difficulties and great prejudices to overcome in manipulation and in the cheapening of the product, and the users of the machines in very many cases were ignorant of the methods to be used. Mr. Palmer's efforts have aided greatly in overcoming these difficulties and this ignorance, and with the cheapening in the cost due to the lower price of cement, the business of making cement blocks has advanced with amazing strides since interest was first strongly awakened in it, for which this magazine claims a fair share of credit, since the beginning of the rapid extension of the business coincided with the notice made in its pages of the new applicant for favor in concrete construction. The extensive sale of the machine shows its popularity, based on its adaptability to the conditions.

Mr. Palmer has just completed a large apartment building constructed of his blocks on Mount Pleasant Heights, N. W. Washington, D. C., on the lower floor of which are his offices and also his residence.

The accompanying illustration shows the Law Exchange, erected at Jacksonville, Fla., of the Palmer block. The title of Mr. Palmer's company is The Palmer Hollow Concrete Building Block Company, Washington, D. C.

Stevens Cast Stone.

In the multiplicity of machinery and methods for making cement blocks and artificial stone the earliest method of casting artificial stone, should not be lost sight of. This is the Stevens method,



The Post.
Section of Post.
Trussed Core of Post.

The Post with Board Fence.

The Post with Wire Fence.

PRATT'S CONCRETE FENCE POSTS.

using sand molds and concrete wet enough to pour into the molds and fill them properly. The development of this method whereby sand cores are used in making blocks, makes it possible to use a minimum of expensive forms. Metal cylinders or prisms surround the sand cores during the process of forming the stone, and they can be removed as soon as the stone is finished, leaving the sand in place to support the concrete until it has set. The Stevens Cast Stone Company, 808 Chamber of Commerce, Chicago, Ill., controls this method. It also claims a patent covering its most popular form of block, which is two slabs connected by posts or piers of concrete, all made at the same time and of the same material.

A Portable Cement Block Machine.

Pettijohn Brothers of Terre Haute, Ind., have put on the market a new machine for making cement concrete blocks for which they claim several advantages, such as making the blocks on the floor, quick changes of face plate, absence of springs, levers, cogs or gears. The blocks are made on the spot where they are to remain for curing and the machine is taken away from the completed block and set up in position for the next block. Iron pallets or planks for moving the blocks are therefore not necessary. The machine is simple, light and easily moved.

An Everlasting Cement Post.

A new cement post is put on the market by Leverett A. Pratt of Bay City, Mich., which has some points of interest. The core of the post is a strip of wood trussed with No. 8 galvanized wire which has projecting loops at proper intervals to serve as fasteners for the wire or boards used for fencing material. This core, with its attached wire, is held in proper position in the galvanized iron mold, which is set on end. Concrete of cement, sand and gravel or broken stone is mixed wet enough to pour and the mold is then filled, making a firm, non-porous stone post with a smoothly finished surface. The flask is then hung up until the post is cured ready for the market. A wire fence may be attached directly to the wire loops projecting from one surface of the post. A board fence may be similarly attached or a nailing strip can be attached to the post to which the fence boards may be nailed. Concrete posts do not rot, burn or corrode, and can be set so that they will not be lifted by the frost. The cuts on the opposite page show the construction of the post.

The Value of Advertising.

The Noyes F. Palmer Manufacturing Company put on the market one of the earlier machines for making concrete building blocks, which it claims as the original adjustable mold press for making hollow or solid blocks. After a year's use of the advertising pages of Municipal Engineering Mr. N. F. Palmer says that he knows of no publication giving so much space to the subject and he gives the magazine a great share of the credit for his monthly rush of correspondence, which has now come from nearly eight hundred different localities. The results of the advertisements and the correspondence seem to be equally satisfactory to buyer and seller of machines.

Trade Publications.

The Universal Safety Tread Company, 45 Broadway, New York, describes in a catalogue their method of giving a lead surface for travel on steps for cars, stairways, ladders, etc.

Worthington meters are listed in a little descriptive catalogue of Henry R. Worthington, 114 Liberty-st., New York.

The latest catalogue of the Jeffrey Manufacturing Company, Columbus, O., is No. 57A, describing their machinery for the sawmills, lumber and wood-working industries.

The Pope Manufacturing Company, Hartford, Conn., sends a valentine as a reminder of the coming season for its wares.

Calendars have been received from the National Electric Company, Milwaukee, Wis.; the American Cement Company, Philadelphia, Pa.; F. L. Smidth & Co., New York City; Troy Public Works Company, Utica, N. Y.

Julian Scholl & Co., 126 Liberty-st., New York City, send circulars regarding their reversible horse rollers and the Babcock hardpan plow.

TRADE NOTES.

ASPHALT.

The Whippell heirs of Kentucky have made application for the appointment of a receiver for the Federal Asphalt Company, claiming that the company has not

a clear title to the land on which the rock asphalt is mined. The claims aggregate $15,000.

Judge Kohlsaat appointed the Chicago Title & Trust Company receiver in bankruptcy of the assets of the Federal Asphalt Company, Feb. 19. The petition for a receiver alleges that the company has been insolvent for more than four months, and sets forth several acts in bankruptcy as having been committed by members of the company, one of which is that the company paid a bill to the Central Coal & Iron Company, preferring that company over other creditors. It is also alleged that the corporation's liabilities are between $325,000 and $475,000, and that the assets are considerably below this mark; that Joseph Huffaker and William L. Breyfogle claim to own a first mortgage on the property of the asphalt company for $100,000, and that other liabilities reach a total of more than $300,000. The assets of the company are said to include a large tract of land in Kentucky, where the concern's principal holdings are located, sundry stores containing merchandise, and accounts and bills receivable to the amount of $40,000.

The C. A. Brockett Cement Co., Kansas City, Mo., has attached the tools and equipment of the Federal Asphalt Company of Chicago on a claim of $1,000.75 for cement furnished that company.

BRICK.

The Winamac Cement Pressed Brick Company of Winamac, Ind., has been incorporated to manufacture cement-sand building blocks, and other articles which can be made from a combination of cement and sand. The incorporators are Samuel A. March, George T. Bouslog, Milo E. Bond, Mont M. Hathaway and Charles L. Weeks.

The Amsler Engineering Company, Empire Building, Pitsburg, Pa., has been incorporated under the laws of Pennsylvania to build blast, open hearth, heating and melting furnaces, and to conduct a general contracting business in brick and concrete. The company has secured a contract from the American Steel and Wire Company to erect one furnace and four hot blast stoves at Cleveland. O. W. O. Amsler, president; A. C. Davis, treasurer.

A plant for the manufacture of sand brick will be constructed at Ft. Smith, Ark., under the direction of J. T. Rabb, a millwright of Bonham, Tex.

A vitrified brick and sewer plant is said to be needed at Paris, Tex.

CEMENT.

The Guarantee Cement and Stone Company, northwestern sales agents for the cement department of the Illinois Steel Company of Chicago have moved to 704 New York Life building, Minneapolis, Minn.

The Milwaukee Crushed Stone Company, Milwaukee, Wis., has been incorporated to manufacture, buy and sell stone, lime and cement by Carl F. Geilfuss, Joseph V. Quarles, jr., and Arthur Wenz.

The Western Cement Company was awarded the contract for furnishing the city of Detroit, Mich., with natural cement during the year at 62 cents per barrel.

The American Cement Post Company has been organized at Marshall, Mich., and will be licensed by trustees of basic patents on fence and other posts of cement to manufacture such products throughout the United States. The first plant will be established at Grand Rapids, Mich. The officers of the company are: President, S. F. Dobbins, Marshall; vice-president, F. A. Stewart, Marshall; secretary and manager, M. Gray, Marshall.

The Ajax Portland Cement Company, recently incorporated by Edward H. and Hiram C. Bennett of New York City and Harry H. Starrett of Bayonne, N. J., has purchased the Tice-McCray estate, one mile west of Pattenburg, N. J., and will open a quarry and establish a cement plant.

The Cincinnati Cement and Blacking Company, Cincinnati, O., has been incorporated by H. H. Patton, F. S. Patton, A. F. Ryan, W. Hughes and J. A. Carr.

The Logan Portland Cement Company is preparing to build a cement plant at Fenton, Mich., according to press reports.

The Portland Cement Construction Company, Milwaukee, Wis., has been incorporated by Charles Becker, William Grell and Charles B. Frick.

The Anadarko Plaster and Cement Company, Anadarko, Okla., has been incorporated by Homer W. Dunbar, H. G. R. Gillette, J. D. Thompson, James F. Stick, T. B. Page, J. G. Gallagher, George Baker, J. E. Tarrington, J. D. Nicholson, W. J. Lacy and A. W. Koontz.

The Gulf States Portland Cement Company, Huron, S. D., has been incorporated.

We are advised by the Edison Portland Cement Company that the works at New Village, N. J., which have been for some time past under construction, are now completed and in operation. The plant was designed and built under the direct supervision of Thomas A. Edison, the well-known inventor, and contains many novel and ingenious appliances, resulting in great economies in the handling of material, and in uniformity, fineness and product of exceedingly high grade. Owing to superior scientific methods employed, the company is in position to guarantee unusually fine grinding, over 85 per cent. passing 200 mesh and 98 per cent. passing 100 mesh. The present capacity of the plant is 1,500 barrels daily. Much of the equipment, however, is on basis of 10,000 barrels daily, and by June 1 it will have a capacity of 3,000 barrels daily. The plant will gradually be increased by additional units representing 1,500 barrels

daily capacity until the ultimate limit of 10,000 barrels daily will be reached.

The charter of the Iola Portland Cement Company of Dallas, Tex., was filed Jan. 30, at Austin, by Edwin M. Reardon, Jas. C. Duke, of Dallas; Sheldon H. Bassett, St. Louis; Edgar H. Ryan, Davenport, Ia.; Chas. H. Pope, Moline, Ill., the company having acquired the properties of the Texas Portland Cement Company.

The contract for furnishing 4,300 barrels of Portland Cement for use in the extension of the concrete breakwater at Marquette, Mich., was awarded to F. B. Spear & Sons, at $1.79 a barrel.

A new cement company has been organized, according to press reports, to build a plant one-half mile north of the Omega Company, in Scipio, Mich. The new company will be known as the Delta Cement Company. The officers of the company are as follows: President, Wesley Sears, Jackson, Mich.; vice-president, Prof. D. E. Haskins, Scipio, secretary and treasurer, Dr. E. R. Espio, Jonesville.

In the United States Circuit Court at Baltimore, Md., February 5, the Carolina Portland Cement Company obtained a verdict for $4,000, and Ira C. Hutchinson for $2,000 damages against the Maryland Cement Company. The Carolina Portland Cement Company alleged a breach of contract for the delivery of 25,000 barrels of cement in 1902. The amount claimed was $18,000. The Maryland Cement Company claimed that it could not comply with the contract because of inability to secure the necessary slag to make the cement. The verdict of the jury was for the difference of 40 cents a barrel, which it was compelled to pay on 10,000 barrels of cement. Ira C. Hutchinson, in the second suit, claimed $5,000 commission on the cement in the first suit and other sales. The first case was tried before a jury, and the latter before a judge without a jury.

Press reports from Galveston, Tex., that Judge S. W. Jones, referee in bankruptcy, has received from Jens Moller, trustee in bankruptcy of the Texas Portland Cement & Lime Company, a report of the sale to Edgar H. Ryan, of Davenport, Ia., in behalf of the Iola Portland Cement Company for $250,000, of the total assets of the bankrupt company. A majority of the creditors, representing $177,322 out of a total of $193,973 joined in a request for speedy confirmation of the sale. The purchaser is to pay the sum of $223,513 clear of all incumbrances on said properties upon the following terms: $100,000 thereof in ready money upon the delivery of the properties to the purchaser; $15,000 in cash within 30 days thereafter, and the residue within 30 days thereafter; deed to be held in escrow until all the purchase money shall have been paid. The purchaser has also assumed $26,486 worth of liens, which makes the total sale aggregate $250,000. Judge Jones says that the bankrupt company will pay its indebtedness dollar for dollar with interest, and will leave from $25,000 to $40,000 to be distributed as surplus among its stockholders. He had approved the trustee's report of sale, and as soon as the trustee reports to him the expenses of the first dividend of at least 50 per cent. will be declared. Judge Jones is gratified at the outlook for the stockholders owing to the splendid physical condition of the plant and the satisfactory terms of sale, and says that he has never known a bankrupt concern to exhibit a better financial showing.

CONCRETE BLOCKS.

A cement company is being organized at Watertown, S. D., and the names of two or three foremen and the same number of finishers for sidewalk construction are desired. Lee Stover.

The American Concrete Construction Company of Cincinnati, O., has been incorporated by Charles H. Davidson, George P. Walker, J. H. Crawford, C. M. Foster and Charles H. Urban.

The Building Block Manufacturing Company, Minneapolis, Minn., has been incorporated to manufacture hollow concrete building blocks by Samuel Whaley, William F. Porten and Charles W. Buechner of St. Paul and James W. Cooper of Minneapolis.

I. Hawk, Estherville, Ia., contemplates erecting building for the manufacture of cement building blocks.

Charles Atkinson has purchased the interest of I. S. Binford in the Brookings Cement Block Company, Brookings, S. D.

Cement sidewalk blocks will be manufactured by Adams Bros. at Little Falls, Minn.

The Cement Products Company, Webster City, Ia., manufacturers of hollow concrete building blocks, will add cement posts to their product this year.

The Building Material Manufacturing Company, Warsaw, Ind., has purchased an outfit from the Miracle Pressed Stone Company of Minneapolis, Minn., and will manufacture concrete building blocks. The plant will be installed on Winona Lake, 3 miles east of Warsaw. F. F. Lehew will be superintendent.

Russell Brothers, Waverly, Ia., have completed arrangements with the Miracle Pressed Stone Company for an outfit to manufacture the Miracle hollow concrete building block, and have purchased the exclusive right for Butler and Bremer Counties.

The Wapakoneta Cement Block Company, Wapakoneta, O., has been incorporated to manufacture hollow concrete blocks for building purposes.

A. J. Stacer of Chicago has purchased the patent for a cement mold to be used in manufacturing building blocks, and two engines of Charles E. Shumway of Albion, Mich.

The Cement Building Block and Stone Company, Springfield, O., has been organized by Joseph Bolan, Philip Beninger and James Powers, and will establish a plant for the manufacture of cement building blocks.

The Utopian Concrete Block Company, Denever, Colo., has been incorporated by A. C. Haffner, Thomas A. McMurtrie and Charles D. Baker.

The Freeport Concrete Construction Company, 302 Wilcoxen Building, Freeport, Ill., has been organized to manufacture hollow concrete building blocks, by W. H. Shones, J. A. Gale and C. K. Meyers.

A cement brick-making machine is being made for the Delaware Cement Products Company of South Wilmington, Del., by Charles Heinel.

A company has been incorporated at Waterloo, Ia., for the manufacture of cement blocks, with J. H. Stewart as president; George L. Dixon, vice-president; W. M. Law, secretary.

LIGHTING AND POWER.

The Safety Automatic Gas Light Cut-off Company, Kaukauna, Wis., has been incorporated by A. G. Koch, J. M. Jansen, C. A. Walquist and Peter Rademacher.

The United Light & Traction Company, Camden, N. J., has been incorporated to generate electricity for light and power, by M. Leon Berry, Norman Grey and W. B. Walcott.

The National Gas, Electric Light & Power Company, 15 Exchange Place, Jersey City, N. J., has been incorporated to acquire, lease, construct, develop, improve, maintain, operate and deal in lights and franchises of or relating to any and all public utilities. The incorporators are James T. Lynn, Frank K. Pelton and Kenneth K. McLaren.

The Massachusetts Electric Supplies Company, Portland, Mass., has been organized to manufacture and deal in electrical apparatus, by Charles J. Nichols and Edward H. Lounsbury.

Newly incorporated lighting companies: Municipal Electric & Construction Company, St. Louis, Mo.—Chas. C. Diemunsch, William Gottlieb and Joseph Block; The City Gas Company, Washington, Ind.—Bascom Parker, Jules Dick and E. T. Taylor; Monterey Light & Power Company, Jersey City, N. J.—Kenneth K McLaren, Robt. L. Hogust and Roger H. Williams; Virden Electric Light Company, Virden, Ill.—J. N. Hairgrove, U. G. Tucker and C. W. Carn; Aurora, Elgin & Chicago Electric Light, Heat & Power Company, Aurora, Ill.—E. C. Faber, J. T. Huntington and W. P. Harvey.

The Nernst Lamp Company has recently opened an office at 47 State-st., Detroit, Mich., and appointed Mr. Charles F. Case as district sales manager of the same. The territory embraced by this office is the lower peninsula of the State of Michigan, the northwestern part of Ohio and the northeastern part of Indiana.

MISCELLANEOUS.

George M. Pierce, who has for the last three years been secretary and treasurer of the Duplex Manufacturing Company of Cleveland, O., has severed his connection with that company and is now associated with the Pierce Supply Company, American Trust Building, Cleveland, O. The new company manufactures a full line of cast-iron goods for street improvements.

The Decatur Hydraulic Stone and Hard Plaster Company, Decatur, Ill., has been incorporated to manufacture artificial stone and hard plaster, by George Ferre, John Oren and B. F. Stanley.

The Pressed Stone Manufacturing Company, St. Paul, Minn., has been incorporated by George W. Oakes, W. S. Darby and B. S. Oakes.

The Northwestern Artificial Stone Works, Huron, S. D., has been incorporated.

The construction of a plant for the manufacture of artificial stone is contemplated at New Decatur, Ala., by parties from Birmingham and Decatur.

The Nelson Bros.' Paving and Construction Company, Minneapolis, Minn., has been incorporated by John A. Nelson, N. J. Nelson and Harvey V. Smith.

The Universal Stone Machine Company, Jersey City, N. J., has been incorporated by Albert Crockel, S. E. Atwater and John W. Walker.

At the annual meeting of the Acme Road Machinery Company held at the offices of the Corporation at Frankfort, N. Y. on Thursday, January 28, 1904, the following directors were elected for the ensuing year: W. A. Cook, D. B. Cook, James Dempsey, T. G. Ingersoll, J. W. Jones, Philander Pollock, Alonzo Schaupp. At a subsequent meeting of the directors of the company the following officers were elected: President, Philander Pollock; vice-president, A. Schaupp; secretary and treasurer, James W. Jones; general manager, W. A. Cook.

SEWER PIPE.

Pittsburg capitalists have purchased 20 acres of the McGrew farm, according to press reports and will locate thereon a sewer pipe plant.

The Mexican Sewer Pipe Company, Cleveland, O., has been incorporated by J. E. Morley, E. A. Foote, C. H. Gale, L. H. Tolles and Reuben Hitchcock, to mine coal and clay and manufacture sewer pipe, hollow tile, etc.

A sewer pipe plant is needed at Paris, Tex., according to press reports.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

South Bend, Ind.—The Barber Asphalt Paving Company has dismissed its suit against this city in the United States District Court. The original basis of the action was a claim against the city for $3,000 on the ground of services rendered in the paving of street and alley crossings. The company had given the city a receipt in full for the work, but afterward decided that it was entitled to interest in amounts ranging from $150 to $200.

CONTEMPLATED WORK.

Athens, Ga.—Paving is proposed for Barber-st.

Racine, Wis. — Douglas-ave. may be paved. Mayor Nelson.

Terre Haute, Ind.—Brick paving is contemplated for Lafayette-ave.

Asheville, N. C.—Macadam paving is contemplated for Haywood road.

Wichita, Kas.—An ordinance has been passed for paving William-st.

Thomasville, Ga.—Estimates are desired for constructing brick paving.

Monterey, Cal.—About 3 mis. of grading, paving and sidewalks is contemplated.

South Bend, Ind.—The residents on Ohio-st. have petitioned for brick paving.

Ottumwa, Ia.—S. Green and Marion-sts. are to be paved with brick on concrete.

Fairbanks, Ind.—This township voted to construct about 9 mis. of gravel roads.

Millville, N. J.—Bids will be asked in May for street paving. George F. Payne, mayor.

Galveston, Tex.—Brick paving is conplated for Avenues E and F and Twenty-first and Twenty-fourth-sts.

Iola, Kas.—A resolution has been adopted recommending the paving of the alley in block 59.

East St. Louis, Ill.—Paving is contemplated for Nineteenth-st., from State-st. to St. Clair-ave.

Pana, Ill.—(Special).—Bids will be asked for brick paving on concrete base early this spring.

Trenton, N. J.—A resolution has been introduced asking for Federal co-operation in road building.

Oshkosh, Wis.—Asphalt paving is favored for Jackson-st., according to local press reports.

Paris, Ky.—This city is preparing to pave Main-st., from First to Tenth, with asphalt or concrete.

Chattanooga, Tenn.—This city and Jasper will be connected by a macadamized road before next winter.

Anaheim, Cal.—Bids will be asked for in April for constructing cement walks and curb. E. B. Merritt, cy. clk.

Mankato, Minn.—The county board will take action March 22 on the proposed Strand's ravine road matter.

Bay City, Mich.—An ordinance has been passed regulating the construction of stone, cement and brick sidewalks.

Allentown, Pa.—Ordinances have been passed and $20,000 appropriated for street paving. H. F. Bascom, cy. engr.

Moline, Ill.—The village council of East Moline voted, Feb. 15, to construct 10,000 ft. of plank sidewalks.

Hancock, Mich.—Plans and specifications have been received for the extension of the asphalt paving on Quincy-st.

Covington, Ky.—Scott-st. will be paved with Kreodone block, and Banklick and several other streets with brick.

Red Bluff, Cal.—The town trustees have ordered constructed cement sidewalks on both sides of Walnut-st. from Main-st. to the depot.

Huntsville, Mo.—The citizens are in favor of bonding for $10,000 or $20,000 for the purpose of macadamizing the principal streets.

Sherman, Tex.—(Special.)—Charles E. Hayden, cy. engr., says about 4,150 sq. yds. of brick paving, on broken stone foundation, is contemplated.

Chicago, Ill.—New sidewalk ordinances, covering 6 mis., are being prepared. The material will be cement, cinder or stone.

Augusta, Ga.—The question of paving Broad-st. with asphalt, vitrified brick or bitulithic pavement is being considered. Mayor Allen.

Richmond, Ind.—A resolution has been passed for constructing cement curb and gutters on N. Thirteenth and N. Fifteenth-sts. Cy. engr., Weber.

Mooresville, Ind. — (Special.) — D. E. Dolen, town clk., says that contracts will be let about April 1, for about 15,000 sq. ft. of cement walks.

Massillon, O.—Estimates have been prepared for paving as follows: Factory, Canal and Cherry-sts., brick, $9,013; East and Hill-sts., $8,611.

Cincinnati, O.—An ordinance has been passed for paving Schoedinger-ave., from Jonte-ave. to Lierman-ave. with brick. H. L. Gordon, prest. coun.

Kansas City, Mo.—About two and a half miles of asphalt and macadam paving is contemplated on Independence-ave., from Topping-ave. to Blue River. D. W. Pike, cy. engr.

Ashland, Wis.—Council has decided to pave Third-st. and Seventh-ave with macadam, in accordance with the wishes

of the property owners. W. W. Fisher, cy. clk.

Denver, Colo.—Surveys and estimates have been completed for grading and paving about four mls. of streets and boulevards in Montclair, with disintegrated granite.

San Francisco, Cal.—A resolution has been passed for constructing artificial stone sidewalks on Point Lobos-ave. from Williamson-st. to First-ave.

Albany, N. Y.—An ordinance was passed, Feb. 15, over the protests of the property owners, for paving Union-st., between Madison and Hudson-aves., with granite block.

Springfield, O.—City engineer Sievetling has been directed to prepare plans and specifications for paving portions of Center, Fisher, Columbia, Main and Pleasant-sts.

Oakland, Cal.—A bond issue of $3,500,000 is favored, and among the improvements proposed is $230,000 for boulevards and $100,000 for cross-walks and culverts.

Ashland, Ky.—(Special).—Chas. D. Boggess, cy. engr., says that bids will be received about March 1 for 35,600 sq. yds. of brick paving on 6-in. concrete base. W. A. Ginn, Mayor.

Washington, Ia.—Resolutions have been approved for paving Main, Washington, Marion and Iowa-sts. and certain alleys with vitrified brick. A. N. Alberson, Mayor; Hugh H. McCreery, cy. clk.

La Crosse, Wis.—Resolutions have been passed authorizing brick paving on Jay and Mill-sts., and macadam paving on Avon, St. James, Market, Ninth, Eleventh and Jackson-sts., West-ave. and certain alleys.

St. Joseph, Mo.—The Barber Asphalt Paving Company, which had the contracts for resurfacing 4 streets in the business district, has cancelled its contracts, and the work will be re-advertised.

Hancock, Mich.—(Special).—Hon. A. J. Scott, Mayor, says that this city will pave about 8,000 sq. yds. of Quincy-st. with asphalt. The date for receiving bids has not yet been fixed, but will be about May 1.

Louisville, Ky.—The Fiscal Court decided, Feb. 9, to ask for bids for the reconstruction of the Shelbyville and Bardstown pikes with bitulithic pavement for a distance of 1 mile each from the city limits.

Cleveland, O.—An ordinance has been passed providing for vitrified brick paving on Atwater-st. from Miles-ave. to Pratt-st., and dressed block Medina stone paving on Flint-st. from Detroit to Washington-sts. Peter Witt, cy. clk.

Ashland, Wis.—(Special).—W. W. Fisher, cy. clk., says that about 25,000 sq. yds. of asphalt paving and about 2 miles of macadam paving is contemplated. Bids have not yet been advertised, as the plans and specifications are not completed.

Charlotte, Mich.—(Special).—Murl H. DeFoe, cy. clk., says that Riggs & Sherman of Toledo, O., have been engaged to prepare plans and specifications for paving, but the material or time for receiving bids has not yet been determined upon, but will be at an early date.

Harrisburg, Pa.—(Special).—About 100,000 sq. yds. of paving, which may be sheet asphalt, asphalt block, brick and Warren's bitulithic pavement, is contemplated. With the exception of Warren Bros. bitulithic macadam these pavements will be laid on concrete base. M. B. Cowden, cy. engr.

Menominee, Mich.—Albert Hass, cy. engr., has prepared estimates for street paving as follows: Grand-ave.—brick, $28,372.85; bitulithic, $26,091.60; macadam, $15,054.10; asphalt, $28,372.85. State-st.—brick, $19,960.95; bitulithic, $18,193.90; macadam, $10,429.20; asphalt, $19,960.65; Spies-ave., Macadam, $2,204.75; Michigan-ave., macadam, $6,271.50; Jenkins-st., macadam, $2,899.75; Pine-st. and Wells-ave., macadam, $1,832.50; Dunlap-ave., macadam, $1,933.75; Williams-ave., macadam, $1,895.50. Bids will be received in March for the work.

La Salle, Ill.—(Special).—C. M. Rickard, cy. engr., says estimates for brick paving and stone curb for 1904 are as follows: Crosat-st., 10,802 sq. yds., $22,499.94; St. Vincent-st., 10,706 sq yds., $22,499.94; Fourth-st., 7,826 sq. yds., $15,460.14; Tonti-st., 8,593 sq. yds., $16,470.91; Ninth-st, 15,285 sq yds., $29,285.41; Chartres-st., 6,611 sq. yds., $13,691.02; Joliet-st., 18,041 sq. yds., $34,430.20; total, $153,448.58.

CONTRACTS TO BE LET.

Mt. Holly, N. J.—Bids are asked until March 1 for one-third mile of macadam street paving. W. N. Stewart, cy. clk.

Greensburg, Ind.—Bids are asked until 1 p. m. March 7 for constructing a gravel road. Frank E. Ryan, co. audt.

Port Huron, Mich.—Bids are asked until 11 a. m. March 7 for repaving Butler, Broad and S. Military-sts.

Steubenville, O.—Bids are asked until March 10 for grading and macadamizing Neel free turnpike. R. S. Neel.

Muncie, Ind. — Bids are asked until March 1 for paving Jackson-st. with crushed stone. J. E. Mitchell, town clk.

Cincinnati, O. — Bids are asked until March 12 for improving Bloome road, in Sycamore township. E. L. Lewis, co. audt.

Brownstown, Ind.—Bids are asked until March 7 for constructing 2 miles and 4815 feet of gravel roads. Bd. co. comrs.

Lawrence, Kas.—Bids are asked until March 7 for grading, curbing and paving New Hampshire-st. Samuel P. Moore, cy. clk.

Sidney, O.—Sealed bids are asked until 12 m. March 5 for the Bodey pike improvement in Van Buren twp. Charles Counts, co. engr.

Hartford City, Ind.—Bids are asked until 8 p. m. March 3 for paving High, Main and Jefferson-sts. with brick. William Harley, cy. engr.

Versailles, Ind.—Bids are asked until 12 m. March 8 for building 9 miles and 2126 feet of macadamized roads. Nicholas Volz, co. audt.

Louisville, Ky.—Bids are asked until March 15 for constructing 2¼ miles of bitulithic or tar macadam road. R. H. Young, co. surv.

Amsterdam, N. Y.—Bids are asked until March 5 for further improvement of Mohawk River turnpike, No. 108. Edward A. Bond, state engr., Albany.

North Yakima, Wash.—Bids are asked until March 7 for grading and graveling 1 mile of road in Moxee Valley. W. I. Lince, chmn. bd. co. comrs.

Lawrenceburg, Ind. — Sealed bids are asked until 12 m. March 7 for constructing a tree macadamized road in Clay township. Charles M. Beinkamp, co. audt.

Crown Point, Ind.—Bids are asked until March 7 for constructing about 6 miles of gravel roads. Michael Gimmer, co. audt.

Logansport, Ind.—Sealed bids are asked until 2 p. m. March 10 for constructing gravel roads in Deer township. Terrence A. McGovern, chmn. bd. comrs.

Ottawa, Kas. — Bids are asked until March 2 for grading, concrete curbing and 50,000 sq. yds of vitrified brick paving. John C. Quin, cy. clk.

Washington, Ia.—Bids will be received until March 3 for paving N. Marion-ave. from the public square to Railroad-st. A. N. Alberson, mayor; Hugh H. McCleery, cy. clk.

Brownstown, Ind.—Bids are asked until March 7 for constructing a gravel road on the township line between Jackson, Brownstown and Washington twps. Asbury H. Manuel, co. audt.

Washington, Ind.—Bids are asked until March 8 for constructing and improving certain roads in the towns of Montgomery and Elnora. W. H. McCarte, chmn. co. comrs.

Winamac, Ind.—Sealed bids are asked until 12 m. March 8 for improving 31,708 ft. of the Telephone road, and 31,710 ft. of the Winamac and Medaryville road. P. A. Follmar, chmn. co. comrs.

Muscatine, Ia.—Sealed bids are asked until 7:30 p. m. March 3 for 31,300 sq. yds. of brick paving in impvt. dist. No. 22, and 27,390 sq. yds. in dist. No. 21. James J. Ryan, cy. engr.

Mt. Clemens, Mich.—Sealed bids are asked until 6 p. m. March 7 for regrading and repaving Cass-ave. and Walnut and Grand-aves. with brick, asphalt and bituminous macadam. William F. Kracht, cy. clk.

Ottumwa, Ia.—Sealed bids are asked until 7:30 p. m. March 7 for repaving and reconstructing Main-st. from Jefferson to Washington with vitrified repressed paving brick or blocks. H. P. Keyhoe, chmn. st. com.

Geneva, N. Y.—Sealed bids are asked until 10 a. m. March 3 for 10,500 sq. yds. of asphalt, asphalt block and brick paving on concrete, macadam, tar macadam and asphaltic bituminous macadam paving. W. S. Wood, secy B. P. W.

Mansfield, O.—Sealed bids are asked until March 2 for constructing 15,480 lin. ft. of combination cement sidewalk, curb and gutter, 730 lin. ft. separate cement curbing, 5,330 ft. separate cement walk, 800 lin. ft. cement curb and gutter. Briggs Real Estate Company. Also 19,280 sq. yds. of macadam paving.

Shreveport, La.—Sealed bids are asked until 7 p. m. March 21 for paving twenty-nine streets with brick, asphalt and Warren Bros.' bithulithic pavement, or similar pavements. Each street is to be bid on separately. C. G. Rives, compt.

Portsmouth, O.—Bids are asked until March 8 for 55,517 sq. yds of paving, 22,765 lin. ft. curbing, 2,658 ft. edging, twenty-five manholes, 19,805 ft. sidewalks relaid, on Fourth, Market, N. Waller and Clay sts. Filmore Musser, cy. audt.

CONTRACTS AWARDED.

Decatur, Ind.—The contract for macadamizing Thirteenth-st. was awarded to Fred Hoffman for $4,515.

Toledo, O.—The contract for paving Wakeman-st. with Massillon block was awarded to Bodette & Sheehan for $5,384.

Atchison, Kan.—S. M. Missmer & Co., city, secured the contract for paving Mound-st. with brick for $12,828.

Duluth, Minn.—The contract for paving N. Twelfth-st., from Banks to Ogden-ave., was awarded to Warren Bros. of Boston.

Marion, Ind.—The contract for constructing the Brown and Sanderman roads was awarded to Nathan P. Medlin for $9,999.

Elwood, Ind.—The contract for constructing the Hanshaw gravel road has been awarded to Crall & Daniels for $26,747.

Los Angeles, Cal.—The contract for paving W. Citrus-ave. and W. State-st. was awarded to the Barber Asphalt Paving Company.

Rushville, Ind.—Philip Wilk was awarded the contract for macadamizing 3¾ mls. of pike in Richmond twp. for $12,775.

Crookston, Minn.—P. McDonnell of Duluth has been awarded the contract for paving several streets in this city with macadam.

Nashville, Tenn.—The contract for furnishing granite paving blocks was awarded Feb. 10 to Francis Jones & Co. at $45 per 1,000.

St. Paul, Minn.—L. G. Washington was awarded the contract for all stone and cement sidewalks to be built during 1904 for $40,396.

Crookston, Minn.—The contract for paving several streets with macadam was awarded to P. McDonnell of Duluth at $1.68 a sq. yd.

Downers Grove, Ill.—The lowest bids submitted for paving Main-st. with brick was that of A. E. Rutledge of Rockford for $12,593.94.

Savannah, Ga.—The contract for furnishing 40,000 sq. yds. of vitrified brick was awarded to the Georgia Brick and Clay Company of Augusta, for approximately $40,000.

Normal, Ill.—The contract for 3,700 sq yds. of brick block paving was awarded to Geo. W. Bansom of Amboy at $2.05 a sq. yd.; 1,760 lin. ft. cement curb, 34 cts.; total, $7,800.

Toms River, N. J.—The contract for constructing 3¼ mis. of gravel road in Union twp. was awarded Feb. 9 to E. King of Parkertown and Daniel T. Cramm of New Gretna fo $9,164.

Newark, N. J.—The contract for repaving the roadway of the Jackson-st. bridge with creo-resinate wood block pavement was awarded Feb. 118 to David E. Olds, 103 Grafton-st., city, for $8,250.

St. Paul, Minn.—The contract for constructing and repairing cement sidewalks during 1904 was awarded to J. G. Washington for $40,396. The James Forrestal Company will build woooden walks for $15,010.

gravel road extensions have been award.

Washington, Ia.—The contract for 6,306 sq. yds. of brick paving on N. Iowa-ave. was awarded, Feb. 9, to the McCarthy Stone Company at $1.49½ a sq. yd. The work will require about 2,000 ft. of curbing and gutter.

Harrisburg, Pa.—The first contract for the reconstruction of a road under the new road law was awarded, Feb. 11, to Frederick Robinson of Meadville for $11,540.26. The road will extend from Titusville to Hydetown, a distance of 7,708 ft.

Vigo, Ind.—Contracts for constructing the L. W. Bailey and George Sanders ed to George J. Singer for $3,866, and Cook & Brocksmith for $6,266 respectively.

Brownstown, Ind.—Contracts have been awarded for 6 mis. of macadam road in Grassy Fork, Washington and Browntown twps. as follows: De Golyer & Moritz, Seymour, $1,622; Samuel Smallwood, Ewing, $4,066; Wm. H. Shields, Seymour, $1,468.

Peoria, Ill.—M. E. Case was awarded the contract for 10,152 sq. yds. of brick paving on Washington-st., at $1.24 a sq. yd.; exca., 24 cts. a cu. yd.; protection curb, 30 cts.; stone curb, 5x22, 74 cts. a lin. ft.; total, $16,356.

Bay City, Mich.—The stone road commission awarded contracts for supplies, Feb. 20, as follows: Gravel, Peter Malcolm of Saginaw, $1.15 a cu. yd.; crushed hard heads, Legg & Harvey of Oakley, $2.05 a cu. yd.; Bayport limestone, Wallace Stone and Lime Company of Bayport, $1.40 a cu. yd.

Kalamazoo, Mich.—Bids were submitted Feb. 15 for paving South and Park-sts. and Park-place, from W. W. Hatch & Son of Goshen, Ind., and J. E. Conly, on brick; Central Bitulithic Company and Barber Asphalt Paving Campany, on bithulitic pavement; Cleveland Trinidad Paving Company, Central Bithulitic Company and Barber Asphalt Paving Company, on asphalt.

Hartford City, Ind.—(Special.)—William Harley, cy. engr., says contracts were awarded Jan. 25 as follows: Washington-st., 20,419 sq. yds. brick paving on concrete base, combined curb and gutters, W. W. Hatch & Sons, Goshen, Ind., $2.55 a sq. yd.; Walnut-st., 15,852 sq. yds., W. N. Vaughn & Co., Greenfield, Ind., $2.40, J. A. Foster & Co., Attica, Ind., $3.09.

SEWERS.

Plainfield, N. J.—The Cameron Septic Tank Company has filed suit against this city for infringements of that company's patents in the local sewage dispocal plant.

CONTEMPLATED WORK.

Brainerd, Minn.—A sewer is desired in the Second ward.

Gulfport, Miss.—A sewerage system will be established.

Liverpool, O.—The extension of the sanitary sewers is contemplated.

Celina, O.—The question of a sewerage system is again being agitated.

Michigan City Ind.—A three-foot brick sewer on Franklin-st is contemplated.

Bellefontaine, O.—The question of a sewerage system will be considered soon.

Dallas, Ore.—Plans and specifications for a sewerage system will be prepared.

Centerville, Ia.—A complete sewerage system is proposed. T. W. Meers, cy. clk.

Waukesha, Wis.—Council has decided to build a sewer on Rosemary-st. Mayor Harding.

Los Angeles, Cal.—Bids will be asked at once for constructing a storm drain on Hill-st.

Saugerties, N. Y.—The question of a sewerage system will probably be voted on this spring.

Mainistee, Mich.—Pipe sewers will be constructed in Filen, Washington, Hancock and Sixth-sts.

Seneca Falls, N. Y.—The question of building a sewerage system will be voted on in March.

Grantville, Ga.—The construction of sewers is contemplated this spring. F. T. Meacham, Mayor.

Naperville, Ill.—A resolution has been passed favoring the construction of a sewerage system.

Los Angeles, Cal.—Bids are to be asked for constructing the outfall sewer. H. H. Stafford, cy. engr.

Elmwood, O.—The city engr. has been directed to prepare plans and specifications for a sewerage system.

Covington, Ky.—The Willow Run Sewer will be continued from Sixteenth-st. to the south corporation line.

Hamilton, O.—About 8 miles of sanitary and storm sewers is contemplated, according to press reports.

West Hartford, Conn.—Bids will be asked in March for constructing the Charter Oak district sewerage system.

Aurora, Ill.—Plans for one and one-half miles of sewers in dist. No. 6 have been prepared. Myron J. Tarble, cy. engr.

Quincy, Ill.—An eight-inch pipe sewer on Sycamore-st. has been ordered constructed. F. L. Hancock, cy. engr.

Reading, Pa.—This city voted to borrow $945,000 for the completion of the sewerage system and other improvements.

St. Paul, Minn.—A preliminary esti-

mate has been prepared for a sewer on Thomas, Ocean, Oneida, Fauquier and Sinnen-sts.

La Crosse, Wis.—The council com. recommends the construction of twenty-four blocks of sewers on the North Side.

Brookings, S. D.—Plans and specifications have been filed at the city clerk's office for a sewerage system.

Glenville, O.—A storm water sewer on Ethel-st. and a sanitary sewer on Lake Shore-boulevard is contemplated.

Mishawaka, Ind.—A resolution has been adopted for the construction of a trunk sewer on Logan-st. M. W. Mix, mayor.

Longmont, Colo.—Bids will be asked soon for constructing fourteen and one-half mis. of eight to eighteen-in. sewers. C. C. Catkins, cy. engr.

Lenox, Tenn.—J. W. Winkler is chairman of a com. to investigate the construction of a sewerage system. R. J. Rawlings, mayor.

Cloverdale, Cal.—W. T. Brush and Charles E. Humbert are members of a com. appointed to secure preliminary plans for a sewerage system.

Philadelphia, Pa.—The board of survey has approved plans for the construction of branch sewers in different sections of the city.

Oakland Cal.—The bond com of council thinks $70,000 will be necessary for reconstructing the western end of the Main Lake sewer.

Alton, Ill.—An ordinance has been adopted to construct sewers on Spring-st. from Union to Sixth, and from Fourth to Second. Mayor Brueggeman.

West, Duluth, Minn.—Enough petitions have been filed, according to local press reports, to secure a sewerage system for West Duluth.

Hartford, Conn.—A resolution has been favorably reported by the bd. of aldermen appropriating $30,000 for the extension of intercepting sewers.

Perth Amboy, N. J.—New York capitalists have made a proposition to provide a sewer system and a water-works and electric light plant for South Amboy.

Urbana, Ill.—A resolution has been passed authorizing the bd. of local impvts. to secure an engineer to investigate the proposed general sewer extensions.

Waukegan, Ill.—Plans for the completion of the North Side sewer system are being discussed. A public hearing will be given on the matter March 15.

Sackville, N. B., Canada—(Special.)—Thomas R. Anderson, chmn. water and sewerage com. of count., says this town contemplates the extension of the sewerage system.

Harrisburg, Pa.—(Special.)—M. B. Cowden, cy. engr., says that about $40,000 worth of sewerage work is contemplated, but nothing definite has been decided upon yet.

Belleville, Ill.—City Engr. Graner has completed plans for the proposed intercepting sewer and septic tank. He has also been authorized to prepare plans for the Illinois, B and C-st. sewers.

Palataka, Fla.—(Special.)—This city desires to secure the services of an expert sanitary engineer to come here and plat the city for a sewerage system. Address J. M. Blackwell, cy. clk.

San Jose, Cal.—The city engr. will be directed to prepare plans and estimates for constructing sewers, with manholes, storm water inlets, catch basins, etc., in Broadway-st. and San Pablo-ave.

Columbus, O.—An ordinance has been introduced authorizing an appropriation of $46,000 from the sewage disposal plant fund to be used in the construction of an experimental plant south of Moler road.

Newark, N. J.—Surveys will be made for a sewerage system in and around Newfoundland. The proposed plan includes the erection of a septic tank disposal plant below the Macopin intake, and it is believed that such a system would effectually prevent pollution of the water supply.

CONTRACTS TO BE LET.

Sumpter, Ore. — Bids are asked until April 1 for constructing a sewerage system. S. S. Start, cy. recorder.

Windom, Minn. — Bids are asked until March 14 for constructing a ditch near Mountain Lake. J. A. Brown, co. audt.

Atlantic, Ia.—Bids will be received until March 3 for constructing 3 miles of sewers. Iowa Engineering Company, engrs.

Alexandria, Minn.—Bids are asked until 10 a. m. March 7 for constructing ditch No. 3. E. P. Wright, co. audt.

Green Valley, Ill.—Sealed bids are asked until March 8 for constructing an open ditch. D. S. Fisher, chmn. drainage comrs.

Butler, Mo.—Bids are asked until March 7 for constructing a sewage disposal plant and a sewerage system. J. L. Stanley, cy. clk.

York, Pa.—Sealed bids are asked until 7 p. m. March 1 for constructing a system of sanitary sewers. R. E. Cochran, prest. B. P. W.

Portsmouth, O. — Bids are asked until March 8 for the construction of brick and pipe sewers with twenty-five manholes. Filmore Musser, cy. audt.

Port Arthur Ont.—Bids are asked until March 28 for constructing about 7,000 feet of storm sewers and 15,500 feet of sanitary sewers. James McTeigue, town clk.

Washington, D. C. — Sealed bids are asked until March 25 for furnishing and erecting sluice gates at the sewage pumping station. H. B. F. MacFarland, chmn. Dist. Comrs.

Henderson, N. C.—Bids are asked until March 10 for constructing a sewerage system, consisting of 8 miles of 8 to 18-inch pipe sewers. H. T. Powell, secy. bd. internal impvts.

Jacksonville, Fla.—Bids are asked until March 4 for furnishing and laying 1,471 feet of 24 and 30-inch brick drain and about 909 feet of 20-inch terra cotta drain, and building manholes. B. F. Dillon, chmn. w. w. trustees.

Brooklyn, N. Y.—Bids are asked until

March 2 for constructing a sewer through the northern porton of Dyker Beach Park consisting of 2,525 lin. ft. of 36, 90, 102 and 120-inch brick sewers; 11 manholes, 2,480 lin. ft. 12-in. vitrified stoneware pipe subdrain. Martin Littleton, boro. prest.

Dolgeville, N. Y.—Sealed bids are asked until 7:30 p. m. March 28 for 31,000 feet 6 to 18-in. sewer, with flushtanks, manholes and lampholes; also for a large septic tank disposal plant for the system and a small disposal plant for factory, with gate house, gates, pipes and pumps complete. Julius Breckwoldt, prest. bd. sewer comrs.

Shreveport, La.—Sealed bids are asked until 7 p. m. March 21 for constructing 756-ft. 18-in., and 690-ft. 24-in. vitrified piper sewer; 279-ft. 30-in., 363-ft. 42-in. and 373-ft. 54-in. circular brick or concrete sewer; 40-ft. 72-in. brick or concrete sewer with manholes, catchbasins and connections complete. C. G. Rives, comt.

Marshall, Tex.—Sealed bids are asked until March 8 for constructing a system of sanitary sewers, consisting of 3,950-ft. 24-in., 5,020-ft. 18-in., 10,105-ft. 15-in., 5,320-ft. 12-in., 5,420-ft. 10-in., 19,295-ft. 8-in., 64,985-ft. 6-in. pipe, 280 anholes, 78 flushtanks, 35 tons of c. i. pipe laid with lead joints. M. S. Rice, sec'y.; J. W. Maxey, con. engr., Houston

CONTRACTS AWARDED.

Red Oak, Ia.—The contract for a sewerage system was awarded to Shepard & Hanrahan of Des Moines, for $6,300.

San Francisco, Cal.—The contract for building a sewer in Cedar-st. was awarded to Fred Leffer, at $1.65 a lin. ft.

Belleville, Ill.—Brauch & Co. was awarded the contract, Feb. 10, for constructing a sewer on Pennsylvania-ave. for $1,700.

Bayonne, Pa.—The contract for a sewer on W. Thirtieth-st., from Avenue C to Avenue A, was awarded, Feb. 16, to D. Donovan, for $6,098.50.

Grafton, Pa.—The contract for constructing a sewer on Chartiers-ave. was awarded, Feb. 11, to V. Di Giorno & Co., of Pittsburg, for $18,280.

Berwick, Pa.—The contract for constructing a sewerage system has been awarded to Hurd, Sherman & Co. of Syracuse, N. Y., for $46,953.76.

Youngstown, O.—J. P. McCarron was awarded the contract for a sewer in Garland-ave., and Rochford & Comisky for sewers in Rigby and Pearl-sts.

Milwaukee, Wis.—The contract for machinery for the flushing tunnel works was awarded, Feb. 11, to the Allis-Chalmers Company, of Chicago, for $28,600.

Hawkinsville, Ga.—The contract for constructing a sewerage system was awarded to Hallanhan & Costello, of Augusta, and for furnishing pipe to H. Stevens' Sons Co., of Macon.

Ensley, Ala.—The contract for constructing a sanitary sewer system was awarded, Feb. 4, to J. E. Hollingsworth & Co., for $23,945.52, and for storm sewers to W. H. Zuber & Co., for $26,829.43.

St. Paul, Minn.—Sewer contracts were awareded, Feb. 15, as follows: P. J. Ryan, Plato-st., $800; Van Buren-st., $1,248; Earl-st., $676; Mendota-st., $853. D. W. Moore, George-st., $399, and Cherokee-ave., $1,987.

Long Island City, N. Y.—Contracts for constructing sewers were awarded, Feb. 1, as follows: John Herle, Seventh-st., in Elmhurst, $6,702. Gabriel Hill, Sixth-ave., Elmhurst, $3,504; Fourth-st., Elmhurst, $2,605; Eleventh-st., Elmhurst, $1,877; Victor-place, Elmhurst, $1,265; Academy-st., Long Island, $1,917. Queens Borough Const. Co., Ninth and Tenth-sts., $4,586. F. Welch, Lawrence-st., $763.

New Orleans, La.—Contracts for constructing sixty-five mis. of sewers were awarded, Feb. 13, as follows: Irwin Bros., contract "L," $61,447; contract "M," $119,154.50; contract "O," $131,487; total, $311,977.50. A. L. Patterson & Co., contract "J," $63,306.50; contract "K," $95,284.85; contract "N," $95,961.80; total, $280,532.15. U. S. Cast Iron Pipe and Foundry Company, $73,465.25. These bids were received Feb. 2.

WATER-WORKS.

Decatur, Tex.—The water works system of this city has been sold to J. J. Perkins.

Los Angeles, Cal.—The Inglewood Domestic Water Company has been incorporated by Chas. Lloyd, H. L. Martin, L. R. Garrett, J. Cook, W. Rodman, B. P. Garrett of Los Angeles and Frank W. Phelps of Inglewood.

Arcade, N. Y.—The question of municipal water works will be voted on March 15.

Richmond, Ind.—The question of water main extension is being considered. Cy. Engr. Weber.

Puyallup, Wash.—The question of a municipal water plant is again being agitated.

Houghton, Mich.—The question of water works improvements will be taken up during March.

Oswego, N. Y.—Plans are being prepared for obtaining the city water supply from Lake Ontario.

Covington, O.—The construction of water works is contemplated. J. G. Wagner, secy. B. P. A.

Atlantic City, N. J.—In his annual message Mayor Stoy urges a reserve water supply and larger mains.

Fargo, N. D.—The question of purchasing a pump for the water works system will be voted on April 4.

Beaumont, Tex.—The purchase of two complete pumping plants is contemplated. W. A. Ward, secy. Orange Co. Irrigation Company.

Lesterville, S. D.—Bids will probably be opened in June for about 2,000 ft. of water main. J. J. Wagner, cy. clk.

Worcester, Mass.—The plans and specifications for Paxton Dam, which is to be constructed this spring, are about completed.

Kansas City, Mo.—Additional ordinances have been passed authorizing the laying of water mains and installation of fire hydrants.

Tiffin, O.—The citizens have asked council to employ an engineer to prepare plans and specifications for a new waterworks system.

Trenton, N. J.—The adoption of an ordinance providing for the installation of $100,000 worth of new water mains has been recommended.

Bridgeport, Conn.—The establishment of a filtration system is contemplated by the Bridgeport Hydraulic Co., of which Chas. P. Senior is supt.

Hartford, Conn.—The bd. of water comrs. contemplates building another reservoir on West Hartford shed, and enlarging the river pumping station.

Jamestown, N. Y.—Chief engineer Hancock thinks it would be advisable to replace the five boilers at the pumping station with new ones this summer.

Binghamton, N. Y.—John Anderson, supt., has been directed to prepare specifications and ask for bids for a new pumping engine of 12,000,000 gals. capacity.

Sackville, N. B., Canada.—(Special.)—Thomas R. Anderson, chmn. Water and Sewerage com. of coun. says this town contemplates the extension of the water works system.

Orange, N. J.—City engr. Crane has been directed to prepare plans for the construction of a new water main from the reservoir to this city.

Harrisburg, Pa.—(Special.)—M. B. Cowden, cy. engr. says that bids will probably be received within a month for a filtration plant. Address B. P. W., 26 S. Second-st.

Coacord, Mass.—This town has asked the legislature for permission to issue $100,000 water bonds for the extension of the water works system. Wm. Wheeler, w. w. comr.

Perth Amboy, N. J.—A proposition has been made by New York capitalists to put in an independent water and electric light plant and sewer system for South Amboy.

Charlotte, N. C.—Preparations will begin at once for establishing a water works system west of this city on Irwin's Creek. A new pump, engines and boiler will be installed at once.

Oakland, Cal.—The bond committee has recommended that provision be made for an appropriation of $140,000 for the installation of water meters, in anticipation of the city's owning its water works system.

The question of issuing bonds for the construction of water works systems will be voted on as follows: Arcadia, Fla., Mar. 7; Brookside, Ala., Mar. 8; Alpena, Mich.; Millington, Mich.; Hawkeye, Ia.

Pittsfield, Mass.—A new supply reservoir to be built above the present distributing reservoir has been recommended by the bd. of pub. wks. The more general use of water meters is also recommended.

Tacoma, Wash.—The Mt. Tacoma Water Supply Company has asked council to appoint a committee to investigate its water with a view of entering into a contract with the company for furnishing this city with water.

Port Townsend, Wash.—The city council has recommended the passage of an ordinance calling for a special election to vote bonds for building a municipal water works system. The matter will be voted on Mar. 12.

Columbus, O.—The council com. on w. w. and finance has decided to recommend the adoption of a resolution to submit a proposition to issue $1,500,000 bonds for a water purification and softening plant to a vote of the people this spring.

Sherman, Tex.—(Special)—Charles E. Hayden, cy. engr., says that bids will probably be received March 7 for constructing a standpipe and extending the mains, plans for which are not yet complete. Some water works machinery is also to be purchased soon, but this is dependent on the water supply now being sought.

The construction of water works systems is contemplated at the following places: High Springs, Fla.; Salem, Ill.; Arion, Ia.; Glasgow, Mont.; Lyndon, Wash.; Bronson, Mich.; Kensington, Minn.; Louisa, Ky.; Seaside, Ore.; Milton, N. H.; Northfield, Vt.; Charlottesville, N. Y.; Millville, N. J.; Toccoa, Ga.; Ft. Gaines, Ga.; Vermillion, O.; Cedar Bluffs, Neb.; Granite, Okla.

CONTRACTS TO BE LET.

Key West Barracks, Fla.—Bids are asked until March 19 for installing a water main. Address Q. M.

Bardstown, Ky.—Bids are asked until March 8 for constructing a water works system. W. T. Eidson, cy. clk.

Belzoni, Miss.—Bids are asked until April 5 for constructing a water works system. S. Castleman, mayor.

Osceola, Ia.—Sealed bids are asked until March 8 for constructing a water works system. W. N. Temple, cy. clk.

Murray City, O.—Sealed bids are asked until March 15 for constructing a water works system. Harry Frazee, vil. clk.

Durant, Ind. T.—Sealed bids are asked until 8 p. m., March 2, for constructing a water works system and standpipe. W. L. Poole, mayor.

Ligonier, Ind.—Bids are asked until March 9 for rebuilding the water works and purchasing pumps and boilers. Mr. H. Jeanneret, cy. clk.

East Orange, N. J.—Sealed bids are asked until March 7 for constructing a reinforced concrete reservoir at South Orange. Stephen M. Long, cy. clk.

Atlantic City, N. J.—Sealed bids are asked until March 8 for laying 300 ft. of 12-in. submerged main. Louis Kuehnle, chmn. bd. water comrs.

Bremerton, Wash.—Bids are asked until March 26 for installing a water system at Puget Sound Navy Yard here. Mordecai T. Endicott, ch. bureau yards and docks.

Cambridge, O.—Bids are asked until

March 2 for constructing extensions to the water works system, including pipe, hydrants, valves, etc. Chas. F. Blair, secy. B. P. S.

St. Paul, Minn.—Bids are asked until March 5 for constructing pump house and equipment, including pumps and boilers complete at Ft. Missoula, Mont. J. McE. Hyde, Q. M.

Detroit, Mich.—Sealed bids are asked until March 23 for constructing an intake crib, crib house, river shaft and 3,185 lin. ft. brick tunnel. Edward W. Pendleton, prest. bd. water comrs.

Frankfort, Ind.—Sealed bids will be asked until 12 m. March 15 for constructing and establishing a water works plant and supply of water to city for both public and private use. Otto Wolf, cy. clk.

Chickamauga Park, Ga.—Bids are asked until March 10 for constructing a pumping plant, including pump and boiler house, pumping machinery and connections to wells and reservoir at new military post here. Capt. H. W. French, Q. M., Chattanooga, Tenn.

Columbus, O. — Bids are asked until March 8 for furnishing a full and adequate supply of pure water to school buildings and school library by means of filters, drilled wells, boiled water, or any other method. J. A. Williams, clk. bd. of education.

Lethbridge, Alberta, N. W. T.—Bids are asked until March 31 for work and machinery, including masonry foundation, pumping machinery, boilers, well, galleries and pump-house. C. B. Bowman, secy.-treas.; Willis Chipman, ch. engr., Toronto, Ont.

Cienfuegos, Cuba.—Sealed bids are asked until April 2 for furnishing 10,441 feet of of 24 to 4-inch c. i. pipe; 185 tons special castings; 279 24 to 4-inch valves; 130 hydrants; 345 tons structural steel; 11,135 sq. yds. expanded metal; 330,000 lbs lead. F. W. Bennett, ch. engr., San Carlos 128, C. C. Vermuele, New York City.

CONTRACTS AWARDED.

Milton, Ore.—The contract for remodeling the water works system was awarded to the Washington Pipe Foundry Company of Tacoma for $3,500.

Roosevelt, Okla. - (Special.)—Guy A. Parker, cy. clk., says that the contract for a tank and tower and laying two blocks of water mains has been awarded to E. S. Perkins & Co. of this city.

Auburn, N. Y.—The contract for furnishing 20,000 to 25,000 of 12-in. pipe has been awarded to the Warren Foundry and Machine Company of New York City at $22.60 a ton, and specials at 2½ cts. a lb.

Buffalo, N. Y.—The contract for new boilers, stokers, coal conveyors and other machinery for the water works pumping station have been awarded as follows: 10 return tube boilers, Farrar & Trofts, Buffalo, $32,082.84; 10 traveling grate stokers, McKenzie Furnace Company, Chicago, $14,500; induced draft for 16 boilers, Buffalo Forge Company, Buffalo, $5,760; coal and ash handling equipment for 16 boilers, Steel Cable Engineering Company, Boston, $32,650; steam mains for 16 boilers and 9 engines, John W. Danforth, Buffalo, $10,760.

New Orleans, La.—The contract for furnishing pipe, specials, etc., was awarded to the United States Cast Iron Pipe and Foundry Company, New York City, as follows: For 2,600 tons straight pipe, $23.67 per ton; 42 tons of 20 and 36-in. flexible joint pipe, $65 per ton; 15 tons special castings, $65 per ton, and valves, $4,468; total bid, $73,465. The only other bid received was that of the Camden iron works, Camden, N. J., which bid for straight pipe, 1,650 tons 48 and 36-in., $24.87; 660 tons 20, 18, 16 and 12-in., $25; 150 tons 6 and 4-in., $26.60, and for 42 tons 20 and 26-in. flexible joint pipe, $34 per ton; 15 tons special castings, $58 per ton; 60 tons special castings, $65, and for valves, $2,388; total bid, $75,516.

BRIDGES.

Angola, Ind.—Bids are asked until March 8 for three iron bridges. Bd. co. comrs.

Winchester, Ind.—Bids will be received until March 8 for building 16 new bridges.

South Bend, Ind.—Bids are asked until March 9 for building two iron bridges. John W. Harbon, co. audt.

St. Joseph, Mo.—Petitions for building eight steel bridges are being considered by the Pettis County Court.

Asbury Park, N. J.—Bids are to be asked for building a bridge at north side of Toms River at Main-st.

Scranton, Pa.—Bids are asked until March 12 for building several small county bridges. E. A. Jones, co. compt.

Boonville, Ind.—Bids are asked until 2 p. m., March 7, for constructing an iron bridge. R. D. O. Moore, co. audt.

Sacramento, Cal.—Bids are asked until March 7 for a trestle over water course ¼-mi. south of Walsh's Station.

Chicago, Ill.—Bids are asked until April 13 for a new bascule bridge over the Chicago river at Harrison-st. Drainage bd.

Versailles, Ind.—Bids are asked until 12 m. March 8 for constructing 2 wagon bridges and abutments for 2 wagon bridges. Nicholas Volz, co. audt.

Virginia City, Mont.—Bids are asked until March 11 for building a 2-span iron or steel flat truss bridge over Big Hole River. Bd. co. comrs.

Greensburg, Ind.—Bids are asked until March 7 for building an arch bridge over Clifty Creek. Separate bids will be received on stone or concrete bridge.

Butte, Neb.—Bids are asked until March 7 for building 5 combination steel bridges over Ponca Creek, and 1 over Kaya Paha River. D. A. Sinclair, co. clk.

Atlanta, Ga.—Capt. R. M. Clayton, cy. engr., has completed plans for a new steel viaduct to be built over the Southern railroad tracks on Edgewood-ave.

St. Paul, Minn.—A bill has been introduced asking for permission to build a wagon and foot bridge across the Mississippi River to connect the towns of Elk River and Otsego.

Battle Creek, Mich.—Council has adopted a resolution authorizing the cy. engr. to prepare plans and specifications for a bridge at McCamly-st. C. A. Jackson, Chmn. bridge com.

Atlanta, Ga.—Bids are asked until March 31 for building a bridge over Chattahoochee River between Fulton and Cobb Counties. H. E. W. Palmer, chmn. comrs. roads & revenue of Fulton County.

Cleveland, O. — Bids are asked until March 2 for constructing steel superstructure for bridge on Town line road between Brecksville and Royalton. Bd. co. comrs. William H. Evers Engrg. Co., engrs., 237 Arcade Bldg.

Salem, Ind.—Bids are asked until March 7 for building a steel bridge over Highland Creek at Quarry Ford, in Washington twp. Separate bids will also be received for stone work, fills, approaches and steel work. Frank E. Morris, co. audt.

Brookville, Ind.—Sealed bids are asked until 12 m. March 7 for reflooring two bridges and building a beam truss bridge and stone superstructure across Bull Fork at the crossing of the Clarksburg road, in Salt Creek twp. Charles A. Miller, co. audt.

Chicago, Ill. — City Engineer Spengler has asked the finance com. of Council for appropriations of $40,000 to begin work on the proposed bridge across the river at Archer-ave., and $50,000 with which to make plans and specifications for ten other bridges.

Belle Plaine, Minn.—Bids are asked for building stone piers or abutments of the Raven Stream bridge, town to furnish cement and sand. A. J. Irwin, town clk. Bids are also asked for constructing the steel work and material for wagon bridge on stone abutments. A. J. Irwin, town clk.

Indianapolis, Ind.—Sealed bids are asked until 10 a. m. March 14 for building a bridge on White River and Fall Creek road, Washington twp.; over Buck Creek, sec. 2, Perry twp.; over Buck Creek sec. 11, Perry twp.; over Buck Creek, bet. Perry and Franklin twps.; over Bean Creek, Center twp. John E. McGaughey, chmn. co. comrs.

STREET LIGHTING.

South Norridgewock, Me.—An electric light plant is proposed.

Logan, Utah.—This city voted to build a municipal electric light plant.

Sparta, Wis.—The question of building a municipal gas plant will be voted on.

Beloit, Wis.—Bids will be asked soon for plans for a municipal lighting plant.

Santa Cruz, Cal.—The construction of another electric light plant is proposed.

Neenah, Ill.—The business men are considering the construction of an electric light plant.

Valatie, N. Y.—The question of establishing a municipal lighting and pumping station will be voted on soon.

Newcastle, Pa.—Council has authorized the preparing of plans for a $65,000 municipal electric light plant.

Walnut, Ia.—Bids are asked until March 1 for an electric light and power plant. A. R. Longnecker, town clk.

Watseka, Ill.—Bids are asked until March 15 for an electric street lighting contract. C. L. Abell, cy. clk.

Omro, Wis.—The Omro Electric Light Co. has been incorporated by John Challoner, L. S. Lighton and S. Lighton.

Belzona, Miss.—Sealed bids are asked until April 5 for building an electric light plant. S. Castleman, mayor.

Columbia, Tenn.—Bids are desired for building and equipping an electric light plant. W. A. Dale, chmn. light committee.

Mt. Clemens, Mich.—The street lighting was awarded Feb. 15 to the Mt. Clemens Electric Co., for 5-yrs. at $58.12 per light per year.

Bay City, Mich.—The question of issuing $50,000 bonds for making additional city electric lighting plant will be voted on April 4.

Des Moines, Ia.—Sealed bids are asked until March 16 for an electric light system at Ft. Des Moines. Maj. R. B. Turner, Q. M.

Burlington, Ia.—Council has appointed a committee of four to investigate the feasibility of building a municipal electric light plant.

Newport News, Va.—A bill has been introduced authorizing this city to issue $100,000 bonds for the construction of an electric light plant.

Waycross, Ga.—Harding Johnson, a New York capitalist, and others have applied to the City Council for a franchise to establish a $100,000 gas plant.

Kemps Creek, Ala.—Plans and specifications for an electric light plant will be desired about March 15, by Frank F. Taylor, who secured a franchise here.

Benton Harbor, Mich.—The contract for 125 arc lights for five years was awarded to the Benton Harbor and St. Joseph Electric Light Company at $47 per light per year.

Baton Rouge, La.—An ordinance has been introduced authorizng the organization of a new electric light company. Prof. Henry Kretz and Edward Weick are interested.

Brooklyn, N. Y.—A resolution has been introduced asking for the appointment of a committee of five to investigate the question of establishing a municipal gas plant.

Lincoln, Neb.—The City Council has passed an ordinance to submit to the voters the question of issuing $65,000 bonds to erect a municipal electric light plant.

St. Paul, Minn.—The contract for an electric lighting system at Ft. D. A. Russell, Wyo., was awarded to the McBride-Downing Electric Company of this city for $23,965.

Aurora, Ind.—The contract for lighting this city was awarded Feb. 22 to the Sun Vapor Street Lighting Company of Canton, O., at $20 per lamp for 100 gasoline street lamps.

Richmond, Va.—Sealed bids are asked until March 8 for installing a lighting and heating plant in the new cell buildings of the Virginia State Penitentiary. W. W. Baker, chmn. Pen. Bldg. Com.

The question of issuing bonds for construction of electric light plants has been favorably voted on at the following places: Jonesboro, Ga.; Mason City, Ia.; Sweetwater, Tenn.; Attalla, Ala.; New Haven, Ind.; Jackson, Miss.

Cleveland, O.—The American Lighting Company of Wilmington, Del., has been awarded the contract for lighting incandescent vapor lamps in this city for one year at $23.85 for each lamp now erected, $29.85 for each additional vapor lamp, $2.00 for each post set or reset.

The question of issuing bonds for the construction of electric light plants will be voted on at the following places: Hopkins, Mo., Cicero, Ind.; Penn Yan, N. Y.; Mooresville, N. C.; Ashland, O.; Monticello, Wis.; South Stillwater, Minn.; Lincoln, Neb.; Beaver, Utah; West End, Ala.; Ithaca, Mich.; Stoughton, Wis.; Thomasville, Ga.

Indianapolis, Ind.—The contract for public lighting for ten years was awarded Feb. 24 to the Indianapolis Light & Power Company at $75 a year for each light on both direct and alternating current enclosed arc lamps, and $74 on direct current open arc lamps; $35 a year on 50 c. p. incandescent lamps. Under the old contract this company received $85 a year for each light on a moonlight schedule. Other bidders were George E. Fisher of Detroit and Ernest C. Bruckman of New York City, who represented foreign capital.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Kalamazoo, Mich.—The Domestic Garbage Company has been incorporated.

Plainfield, N. J.—The question of municipal collection of garbage is being agitated. O. L. Jenkins, mayor.

Atlanta, Ga.—Bids are asked until Mach 25 for constructing a garbage plant. Address C. W. Strickler, 326 Empire bldg.

Oakland, Cal.—The garbage contract has been awarded to the Pacific Incinerating Company for a term of twenty years.

Harrisburg, Pa.—N. B. Cowden, ey. engr., says bids have been opened for garbage disposal, but contract has not yet been awarded.

Perth Amboy, N. J.—Sealed bids are asked until March 7 for the gathering and disposal of ashes and garbage. Matthew Weirup, street commissioner.

Syracuse, N. Y.—The contract for furnishing this city with ten garbage wagons has been awarded to the Haywood Wagon Company of Baldwinville, N. Y., at $199 each.

Omaha, Neb.—Sealed bids are asked, until 2 p. m., March 4, for the collection and disposal of garbage, dead animals and other refuse for terms of 1, 5, 10, and 15 years. Frank E. Moores, mayor.

Dayton, O.—The Dayton Reduction Company has been incorporated by Charles Michael, W. C. Wuichet, George Wuichet, Walter Wuichet and William Chapman. The company has the contract for disposing of the city's garbage.

FIRE APPARATUS.

Houston, Tex.—Estimates of the cost of new fire alarm system are desired. Mayor Holt.

Trenton, N. J.—The purchase of three new steam fire engines, one new fire house and the installation of a fire company has been recommended to the common council.

Sackville, N. B., Canada.—(Special.)—Thomas R. Anderson, chmn. water and sewerage com. of coun., says this town contemplates establishing an electric fire alarm system, but has not yet decided what system to adopt. An inexpensive and efficient system is desired.

Knoxville, Tenn.—The purchase of one second-class fire engine, 5,000 feet of hose, two cellar pipes and the equipment of a hook and ladder truck is recommended. The rewiring of the fire alarm system and several additional fire alarm boxes are recommended in the report of Herman Schenk, city electrician.

SHREVEPORT, LA., SEWER CONSTRUCTION.

(1) Sealed proposals will be received at the office of the City Comptroller until 7 P. M., March 21, 1904, for constructing the following sewers:

756 feet of 18-inch vitrified pipe sewer.
690 feet of 24-inch vitrified pipe sewer.
279 feet of 30-inch circular sewer, brick or concrete.
383 feet of 42-inch circular sewer, brick or concrete.
373 feet of 54-inch circular sewer, brick or concrete.
40 feet of 72-inch circular sewer, brick or concrete with manholes, catch-basins and connections complete.

(2) Plans and specifications may be seen and blank proposals obtained at the office of the City Engineer.

(3) A certified check equal to 10 per cent. of estimated amount of contract, payable to the Comptroller of the city, must accompany each bid as a guarantee that if the bid is accepted a contract will be entered into. A bond equal to 50 per cent. of the amount of the contract will be required for the faithful completion of the work and as surety against all claims for material and labor.

The city reserves the right to reject any and all bids.

C. G. RIVES,
Comptroller.

NOTICE TO CONTRACTORS.

Notice is hereby given that the Common Council of the City of Frankfort will receive sealed bids, at the City Clerk's office of said city, up to 12 o'clock M. of Tuesday, the 15th day of March, 1904, for the construction and establishment of a water-works plant and supply of water to said city for both public and private use. For particulars inquire at the office of Otto Wolf, City Clerk, City of Frankfort, Indiana.

By order of the Common Council of the City of Frankfort, Indiana.

In witness whereof I have hereunto set my hand and affixed the seal of said city, this 12th day of February, 1904.

OTTO WOLF, City Clerk,
City of Frankfort, Indiana.

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